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Railway Mechanical Engineer

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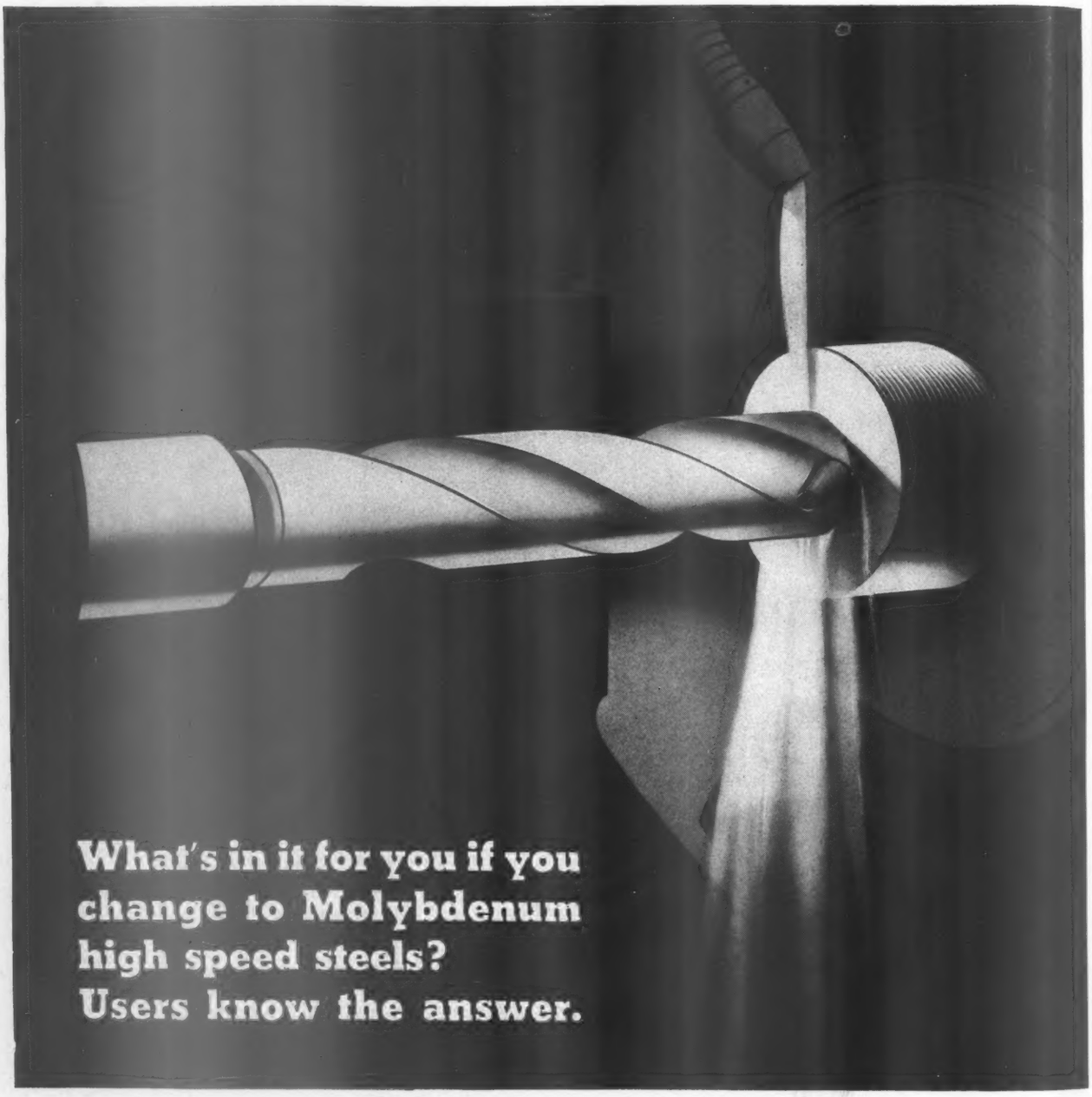

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NOVEMBER, 1941

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BYERS
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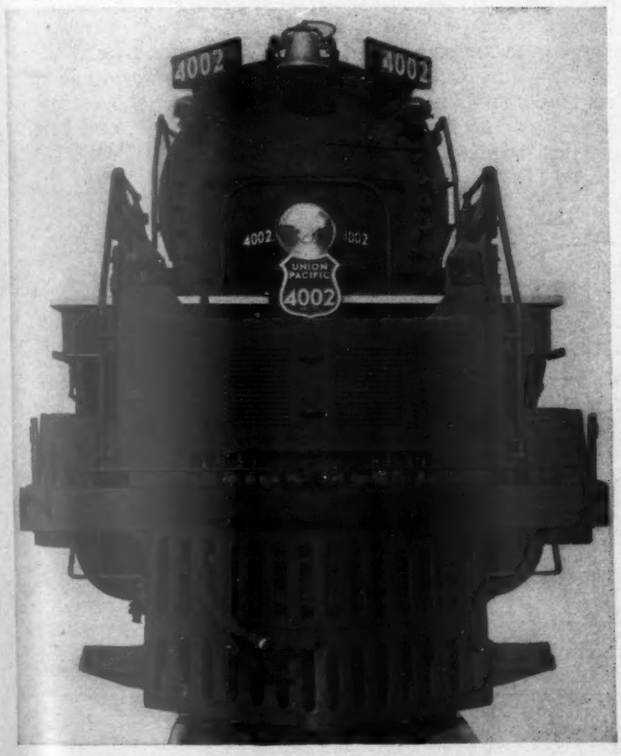
Union Pacific Buys

Twenty 4-8-8-4 Locomotives



With the coupler retracted, the pilot surface is smooth and unobstructed

Heaviest single-expansion articulated locomotives to handle maximum tonnage without helpers on 1.14 per cent mountain grades—Running gear distinguished by high degree of controlled flexibility

TWENTY 4-8-8-4 type articulated locomotives, the largest in size and heaviest in point of total engine and tender weight of any single-expansion locomotives of this wheel arrangement, are being delivered to the Union Pacific by the American Locomotive Company. The length over couplers is 132 ft. 9⅞ in.; the weight of engine and tender, 1,197,800 lb., and tractive force, 135,375 lb. The locomotives are also notable for many refinements affecting their performance.

The basic design was developed by engineers of the Research and Mechanical Standards Department of the Union Pacific, under the direction of Otto Jabelmann, vice-president, to originate a locomotive capable of hauling maximum tonnage and maintaining schedules without helper service over the Wahsatch Mountains on a ruling grade of 1.14 per cent between Ogden, Utah, and Green River, Wyo. Results of exhaustive road tests and experience gained in operation of other single-expansion articulated locomotives were furnished to the American Locomotive Company which collaborated with the Union Pacific engineers in designing the locomotive.

The new locomotives can operate on any part of the railroad and were designed for speeds up to 80 m. p. h. and to produce maximum power output continuously at 70 m. p. h.

The design of running gear permits great flexibility when moving around curves and at the same time provides for relatively high rigidity when operating on tangent track. The spring-rigging suspension of the locomotive also permits adjustment of the wheels to vertical curves with relatively little distortion of the weight distribution.

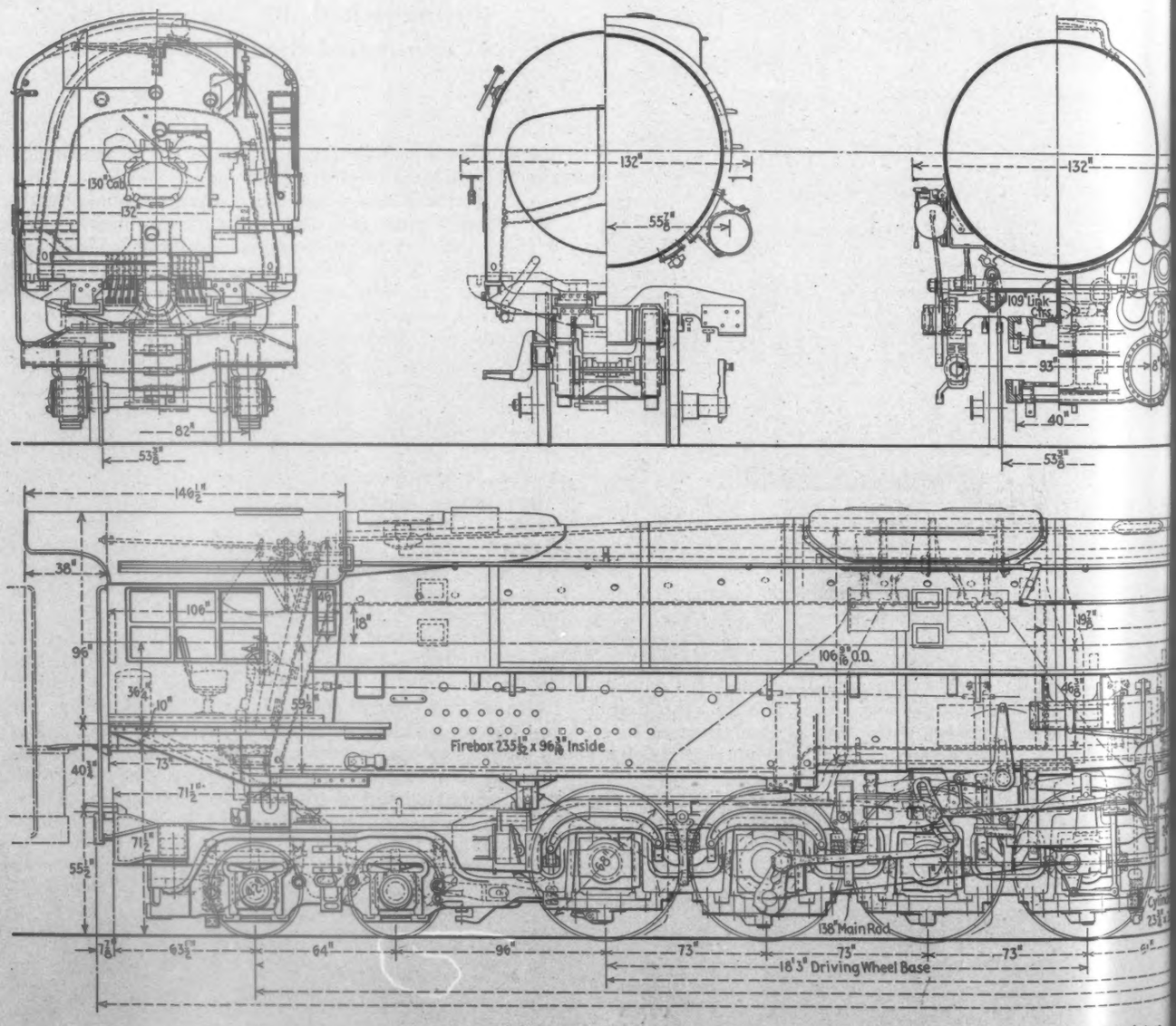
The arrangement of the running gear for tracking on curves embodies what is designated by the builder as the "lever principle." This term is applied to a system of lateral-motion control and spring-rigging suspension, the function of which is to fit all wheels of the locomotives to the rails on curves with maximum freedom from binding and to adjust the wheels to vertical curves encountered with changes of grade with a minimum of disturbance to the distribution of the locomotive weight.

The use of the term "lever principle" arises from the employment of a definitely selected pivot point in the locomotive wheel base about which the mass of the locomotive rotates with respect to the track as the locomotive passes around curves. On an eight-coupled driving-wheel base this is the rear pair of driving wheels in which no provision is made for lateral movement of the axle with respect to the locomotive bed. The guiding wheels on the front engine unit (the front pair of truck wheels and the front pair of driving wheels) have provision for ample lateral movement against controlled resistance. The initial resistance of these wheels is about 17 per cent, increasing gradually as the movement progresses. The second and third pairs of driving wheels adjust themselves freely against a somewhat lower initial resistance and through a somewhat less range of lateral movement than that effective on the guiding wheels. Wheels back of the pivot pair control the movement of the rear end of the locomotive against an initial lateral resistance somewhat lower than that of the guiding wheels. All wheels are fitted to track gage with a setting of 53⅜ in. between the backs of the tires.

The effect of this arrangement is to produce a rigidly guided locomotive when on tangent track which adjusts itself freely on curves with a guiding force cushioned in its application. Locomotives on which this arrangement has been used are said to move around curves smoothly with complete absence of the succession of violent guiding oscillations characteristic of many existing steam locomotives.

In counterbalancing advantage has been taken of the absence of the tendency to nose, brought about by the lateral rigidity of the wheel base on tangent track, to keep down the overbalance. This has been fixed conservatively at 28 per cent of the reciprocating weights.

In order to relieve the tendency of locomotives with long wheel bases to overload the driving springs when passing over convex vertical curves at summits and to under load them with corresponding overloading of the truck springs at the ends of the wheel base when passing over a concave curve an unusual degree of flexibility has been provided in the spring rigging by the employment of coil springs at all points of anchorage of the spring rigging to the engine bed and to the trailer truck. Each of these cushion springs comprises two 8-in. double coils in tandem; they permit the elongation or shortening of what are customarily hangers of fixed length, and permit vertical adjustments throughout the entire wheel base to



Elevation and cross-sections of one of the Union Pacific 4-8-8-4 type

conform to the track with a minimum of distortion of the adhesion weight on the driving wheels. With this arrangement the main springs of the system are designed with an overload factor of only 5 per cent.

Unusual attention has been given to insuring freedom of adjustment of the entire spring-rigging suspension system. Wherever possible, the spring hangers are of the loop type. Alemite lubrication is applied to the circular curved surfaces between the hanger loop and the spring gib. Cross-equalizer hangers have ball ends which hang in removable seats in oil-waste-packed pockets in the equalizer.

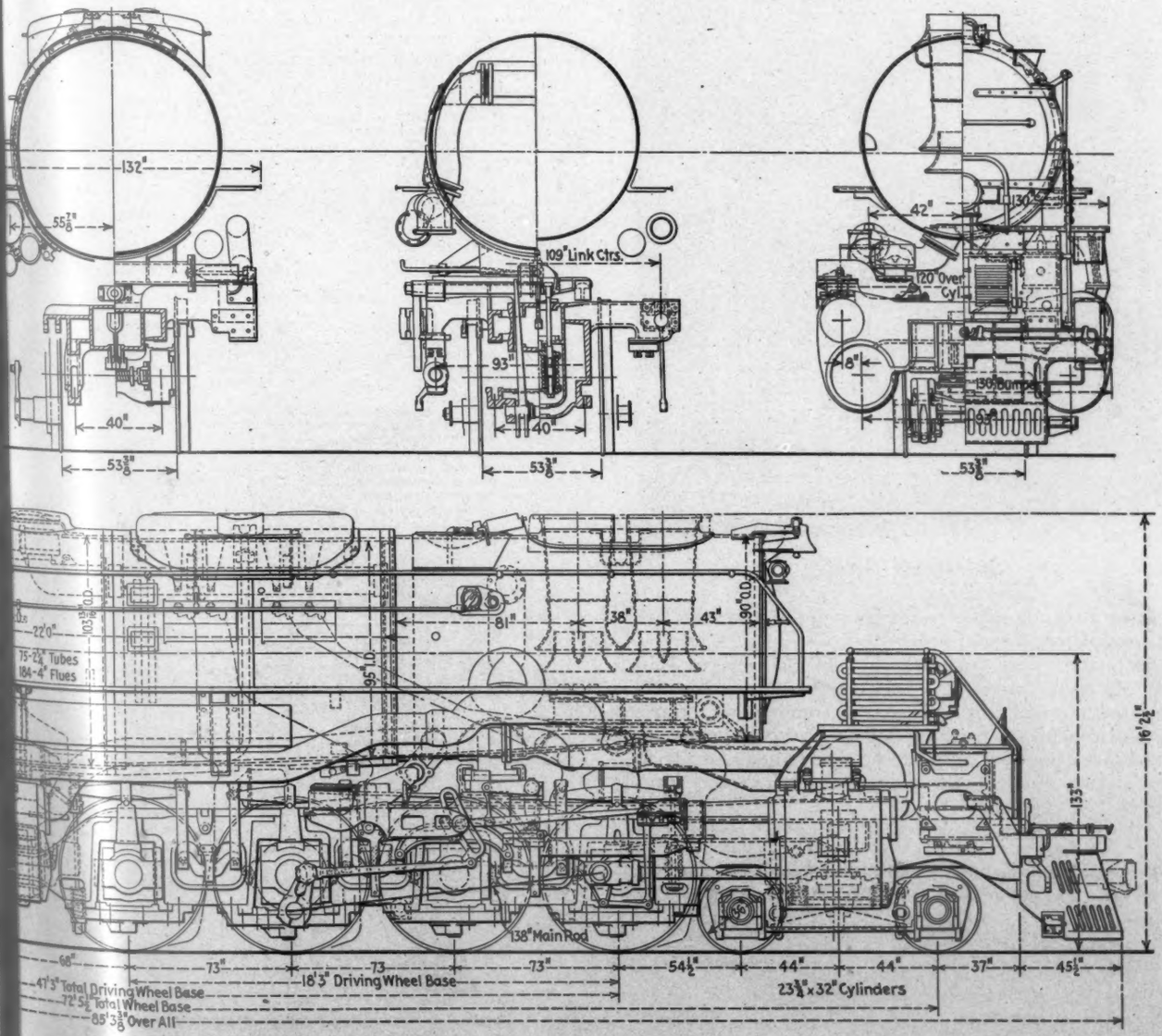
The locomotive as a whole has a three-point suspension. All driving wheels of the front engine are equalized on each side and the two sides are cross-equalized at the front end to the suspension of the rear end of the main equalizer beam, the front end of which bears in the Bissel type center pin of the engine truck. Each side of the rear engine is equalized as a unit from front to back, including both trailer wheels.

Foundation and Running Gear

The two engine beds of the locomotive are connected by a vertical articulation hinge with the pocket and pin at the front end of the rear engine bed and the tongue at the rear end of the front engine bed, which is similar to the arrangement developed by the Union Pacific for their 4-6-6-4 type single-expansion locomotive. The two engine units are so arranged that when the boiler load is applied to the waist-sheet support on the front engine bed a load of about seven tons is delivered to the top of the tongue from the rear engine bed. The two engine units are thus completely rigid in a vertical plane and all adjustments to vertical curvature is through the spring-rigging suspension.

A combination of coil and elliptic springs characterize the Alco four-wheel engine truck. These operate in parallel. The inclined-plane-and-geared-roller centering device has an initial resistance to lateral movement of 18 per cent, increasing to 33 per cent. The center plate is sealed to exclude dust and is force-feed lubricated. Oil is also fed to the racks and roller teeth of the centering device. The wheels are 36 in. in diameter and have SKF inside journal bearings which are tied together with a one-piece top-half integral box, making this a non-self-aligning bearing.

The General Steel Castings four wheel-trailing truck has 42-in. wheels with SKF twin-bearing outside journal



single-expansion articulated locomotives for fast freight service

boxes. It has a centering device with a 10 per cent initial resistance, increasing to 15 per cent and thence remaining constant.

The driving wheels, which are 68 in. in diameter over the tires, are of the Boxpok type. The axle journals have Timken roller bearings. The driving boxes and all other roller-bearing boxes on the locomotive are fitted with heat indicators. Driving boxes are equipped with Franklin compensator and snubber wedge assemblies. Alco lateral-motion devices are applied on the three leading driving axles of each engine unit.

The side rods are of the articulated type, eliminating knuckle-pin connections, similar to those developed by the Union Pacific for their first order of 4-8-4 type freight and passenger locomotives. Vertical grease pockets are located in the bodies of the rods adjoining the crankpins, except for the ends of the rods on the intermediate crank pin. This bearing is lubricated from the hollow bore of the crank pin. The driving axles,

The back head presents an orderly arrangement of valves, gauges, and controls

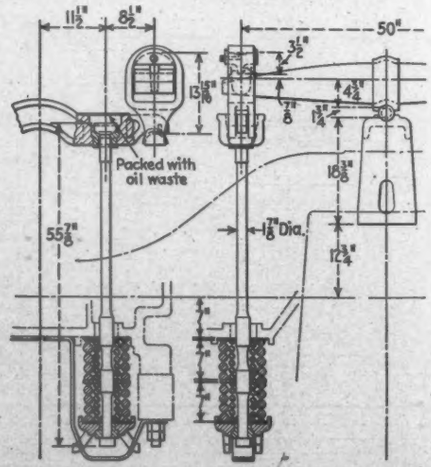
Alongside the firebox

the main and side rods, crank pins and piston rods are heat-treated low-carbon-nickel steel.

The pistons were furnished by the Locomotive Finished Material Company. They are of light alloy-steel rolled section with three T-section combination bronze and cast-iron piston packing rings. The crossheads are manganese-Vanadium alloy-steel castings and operate in multi-bearing guides. The guides are carbon-steel forg-

Principal Dimensions, Weights and Proportions of the Union Pacific 4-8-8-4 Type Locomotive

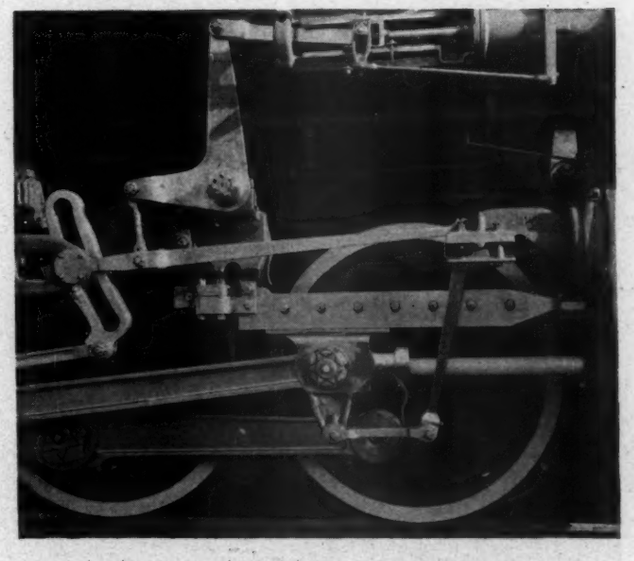
Railroad	Union Pacific
Builder	Amer. Loco. Co.
Type of locomotive	4-8-8-4
Road numbers	4000-4019
Date built	1941
Service	Fast frt.
Dimensions:	
Height to top of stack, ft.-in.	16-2½
Height to center of boiler, ft.-in.	11-1
Width overall, in.	132
Cylinder centers, in.	93
Weights in working order, lb.:	
On drivers	540,000
On front truck	97,000
On trailing truck	125,000
Total engine	762,000
Tender	435,800
Wheel bases, ft.-in.:	
Driving, total	47-3
Front engine	18-3
Rear engine	18-3
Engine, total	72-5½
Engine and tender, total	117-7
Wheels, diameter outside tires, in.:	
Driving	68
Front truck	36
Trailing truck	42
Engine:	
Cylinders, number, diameter and stroke, in.	4-23¾x32
Valve gear, type	Walschaert
Valves, piston type, size, in.	12
Maximum travel, in.	7
Steam lap, in.	1¾
Exhaust clearance, in.	⅛
Lead, in.	¼
Cutoff, max., in full gear, per cent	81
Boiler:	
Type	Straight top
Steam pressure, lb. per sq. in.	300
Diameter, first ring, inside, in.	95
Diameter, largest, outside, in.	106⁹/₁₆
Firebox length, in.	235²/₃₂
Firebox width, in.	96⁹/₁₆
Height mud ring to crownsheet, back, in.	77½
Height mud ring to crown sheet, front, in.	79⅜
Combustion chamber length, in.	112
Security circulators, number	7
Tubes, number and diameter, in.	75-2¼
Flues, number and diameter, in.	184-4
Length over tube sheets, ft.-in.	22-0
Net gas area through tubes and flues, sq. ft.	11.33
Fuel	Soft coal
Grate area, sq. ft.	150.3



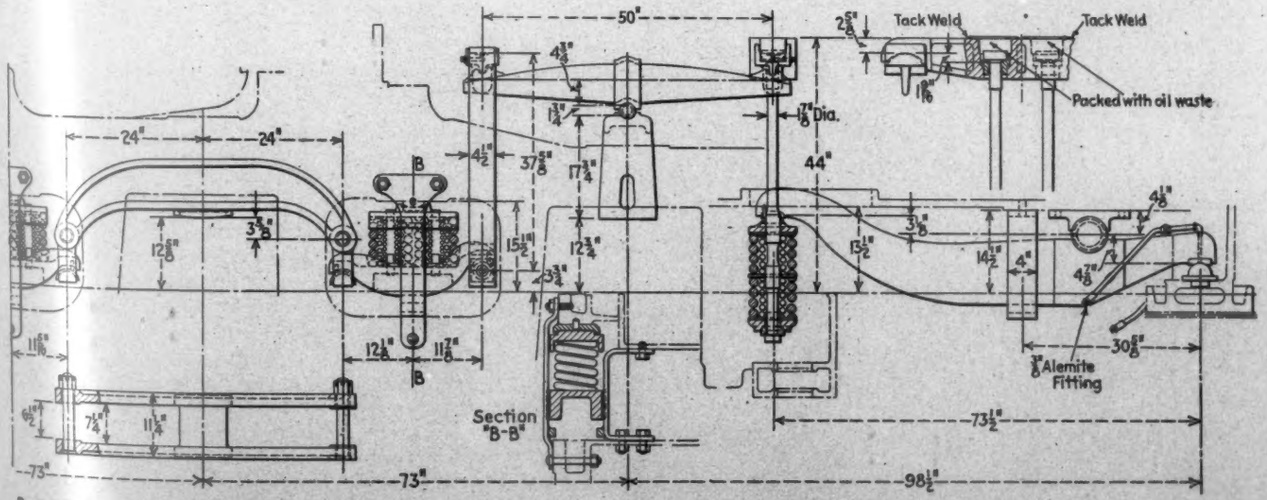
Details of the spring-rigging attachment to the engine bed at the rear end of the front engine unit

The rear end of the front engine unit

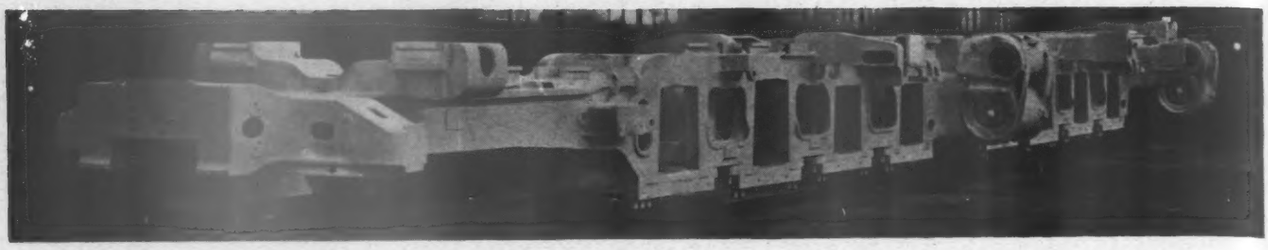
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	593
Security circulators	111
Firebox, total	704
Tubes and flues	5,185
Evaporative, total	5,889
Superheater	2,466
Comb. evap. and superheater	8,355
Tender:	
Type	Water bottom
Water capacity, gal.	25,000
Fuel capacity, tons	28
Trucks (one)	Four-wheel
Rated tractive force, engine, lb.	135,375
Weight proportions:	
Weight on drivers ÷ weight engine, per cent	70.87
Weight on drivers ÷ tractive force	4.00
Weight of engine ÷ evaporative heating surface	129.4
Weight of engine ÷ comb. heating surface	91.2
Boiler proportions:	
Firebox heating surface, per cent comb. heating surface	8.43
Tube-flue heating surface, per cent combined heating surface	62.06
Superheater heating surface, per cent combined heating surface	29.52
Firebox heating surface ÷ grate area	4.69
Tube-flue heating surface ÷ grate area	34.50
Superheater heating surface ÷ grate area	16.40
Comb. heating surface ÷ grate area	55.59
Gas area, tubes-flues ÷ grate area	0.0754
Evaporative heating surface ÷ grate area	39.18
Tractive force ÷ grate area	900.6
Tractive force ÷ evaporative heating surface	23.0
Tractive force ÷ comb. heating surface	16.2
Tractive force × diameter drivers ÷ comb. heating surface	1,101.5



Running-gear details of a rear engine unit



Part of the spring rigging of the front engine unit showing the cross equalization at the rear of the engine-truck equal beam and the use of coil equalizer springs where clearance does not permit the use of semi-elliptic springs



The front and rear engine-bed castings

ings, secured at both ends by heavy clamps so that in adjusting themselves to the lateral expansion of the cylinders the bolts are not subjected to shearing stresses.

The weight of reciprocating parts on each side of the locomotive is 2,106 lb. on the front engine and 1,912 lb. on the rear engine. The weight of the main rod is apportioned between reciprocating and revolving weights by the center-of-percussion method. All revolving weights are balanced in each wheel and overbalance for 28 per cent of the reciprocating weights is divided equally among all wheels. The main driving wheels are cross-balanced. To avoid the use of separate patterns, the primary counterbalance is symmetrical about the diameter through the crank pin and in the wheel center are cast separate secondary counterbalance pockets at either end of the primary counterbalance for the cross-balance correction. One of these is used and closed with a steel plate, welded on. The other is left open. The maximum dynamic augment at diametral speed is 7,590 lb.

Steam Pipes and Steam Distribution

The live- and exhaust-steam pipes applied to these locomotives are larger than those heretofore applied to

The piston and crosshead

any other single-expansion articulated locomotives. Test data developed by the Research and Mechanical Standards Department of the Union Pacific conclusively demonstrated that, to utilize full boiler capacity and develop maximum power output, past practices could not be followed. The arrangement of the steam pipes applied to these locomotives represents a further development of the system of flexible connections to the leading pair of cylinders which has been employed on a number of articulated locomotives previously turned out by this builder. By this system steam from the branch pipes is divided and delivered directly to each pair of cylinders. By the use of a short rotating steam-pipe connection at the cylinder, to the outer end of which the longer flexible connection to the branch-pipe is attached by a flexible joint, these pipes adjust themselves to the lateral movement of the front engine on curves without the use of slip joints. The three flexible connections in each pipe are full ball joints, permitting complete freedom of adjustment. While the use of ball joints at these locations is not new, those installed on the Union Pacific locomotives have been materially simplified in design.

Because of the universal movement permitted by the ball joints, a pair of outrigger studs has been applied to the ball-joint casing at each cylinder. There is normally a small clearance between the ends of the studs and the face plate over which they move as the joint rotates. Should this joint and the pipe arm attached tend to roll out of alignment when there is no pressure in the pipes these studs prevent the pipe from tipping out of alignment.

The main steam pipes to both pairs of cylinders are insulated with Unarco Insubestos pipe covering.

The expansion joint at the rear end of the long steam pipe to the rear cylinders is balanced against the effect of internal pressure.

The cylinders, together with the back cylinder heads, are integral parts of the bed castings. Both cylinders and valve chambers have Hunt-Spiller gun-iron bushings.

The steam distribution is effected by 12-in. piston valves and is controlled by Walschaert valve gear. The valves are Hunt-Spiller lightweight design with Duplex bronze and cast-iron lip-type packing rings.

All pins in the Walschaert valve gear, except the eccentric crank pin are fitted with McGill needle bearings. An SKF self-aligning roller bearing is applied on the eccentric crank pin. The union links, combination lever, radius bars, radius-bar lifters, and valve stems are heat-treated low-carbon nickel steel. The links, link blocks, and valve-motion pins are casehardened.

The reverse gear is an Alco special Type H with a 12-in. by 24-in. cylinder. Compensating springs are applied to the reverse shafts on both engines.

Lubrication

Mechanical application of oil lubrication to these locomotives is effected by four Nathan DV7 36-pint mechanical lubricators with a total of 49 feeds leading through Detroit two- and four-way dividers and terminal checks to 123 oil outlets, exclusive of the air compressors and tender. The points lubricated include the valves, cylinders, cylinder cocks, piston-rod packing, steam-pipe and exhaust-pipe ball and slip joints, the driving boxes and driving-box wedges, guides, engine-truck and trailer-truck center plates, trailer-truck journal boxes, engine-truck lateral-motion device, throttle, reverse gear, articulation hinge pin, stoker, and radial buffer. Two of these lubricators supply cylinder oil to the bearings subjected to steam temperature; the other two furnish lubrication for the chassis bearings.

In addition to the oil lubrication, all spring-rigging joints, brake-rigging pins, and valve-motion bearings have Alemite fittings. In the few points at which pin

connections are used in the spring rigging, the pins fit in Grafitex self-lubricating bushings.

The Boiler

The boiler has three barrel courses and, due to thickness, the sheets were cold rolled and then stress relieved before riveting the seams. The first course is conical with an inside diameter of 95 in. at the front end. The third course, which surrounds the combustion chamber, is 106 9/16 in. outside diameter. All longitudinal seams are of the saw-tooth type riveted and caulked inside and outside; also, all circumferential seams are caulked inside and outside. The firebox is 235 1/32 in. in length by 96 3/16 in. in width, and the combustion chamber is 112 in. long. The crown sheet is about 27 ft. in length and has a relatively small slope; the highest point at the front tube sheet is only 1 7/8 in. higher than the lowest point at the door sheet.

Practically the entire-boiler structure is built of Bethloc steel. This includes the barrel sheets and the firebox wrapper sheets, as well as the entire inside firebox. The front barrel sheet is 1 11/32 in. thick, and the two larger courses 1 3/8 in. each. The smokebox is of three-piece welded construction, to which is attached the boiler bearing, thus relieving the boiler barrel of any shock load which may be transmitted from the front engine unit.

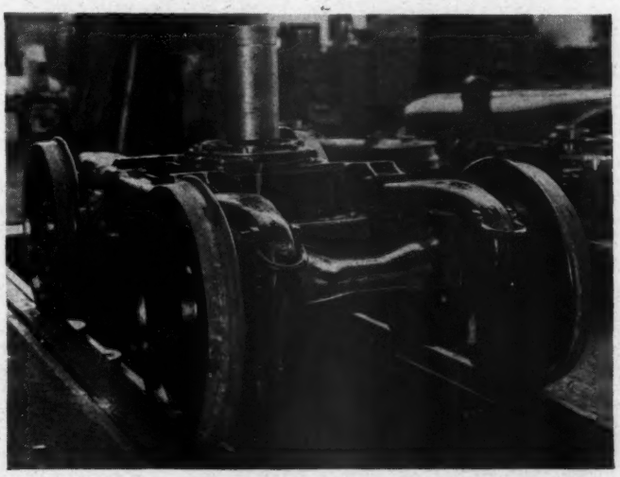
All seams in the firebox, including the attachment of the back tube sheet to the combustion chamber, are welded. At the mud ring the caulking edges of the inside sheets are welded around all four corners, and the outside sheets around the front corners. At the back, the caulking edge of the outside sheet is welded around the corners and entirely across the mud ring. Seal welding is also applied to the outside caulking edges of the wrapper-sheet and back-head seams, to the side- and roof-sheet seams, and to a large part of the front wrapper-sheet seams. The ends of the longitudinal barrel seams are also seal welded.

The Flannery flexible staybolts have the MK type caps. There is a complete installation of flexibles around the combustion chamber and over the crown sheet. There are flexible bolts also along the top of the side sheets, across the top rear corner of the side sheets, and around the rear corners of the firebox. Flexible bolts are also applied at all locations on the back head under the cab deck. The rear firebox corners have radii of 24 in. inside and 25 in. outside at the mud ring, tapering upward to the customary short radii near the top of the side wrapper sheet.

The firebox is supported on the engine bed by four sliding-shoe furnace bearers. Each is enclosed by an oil-tight sheet-steel casing and is immersed in an oil bath.

In the firebox are seven Security circulators and through each side are 20 secondary air tubes.

The boilers have the Electro-Chemical Engineering Company foam-collapsing trough and automatic blow-down system. The Wilson blow-off cocks in the firebox side near the back head are pneumatically operated and are piped into the centrifugal separator which forms a part of the automatic blow-down system. An additional blow-off cock is provided in the belly of the boiler at the front end of the first course, with the nozzle directed toward the firebox for use in blowing down and filling the boiler. Blow-off cocks which are hand-operated from the ground are placed in the sides of the firebox near the throat sheet.



The engine truck

The Firebar grates have 15 per cent air openings. The stoker is the Standard Type MB with the stoker engine installed in the tender. The boiler feed equipment includes a Nathan live-steam injector on the right side and an Elesco exhaust-steam injector with remote control and centrifugal pump on the left side.

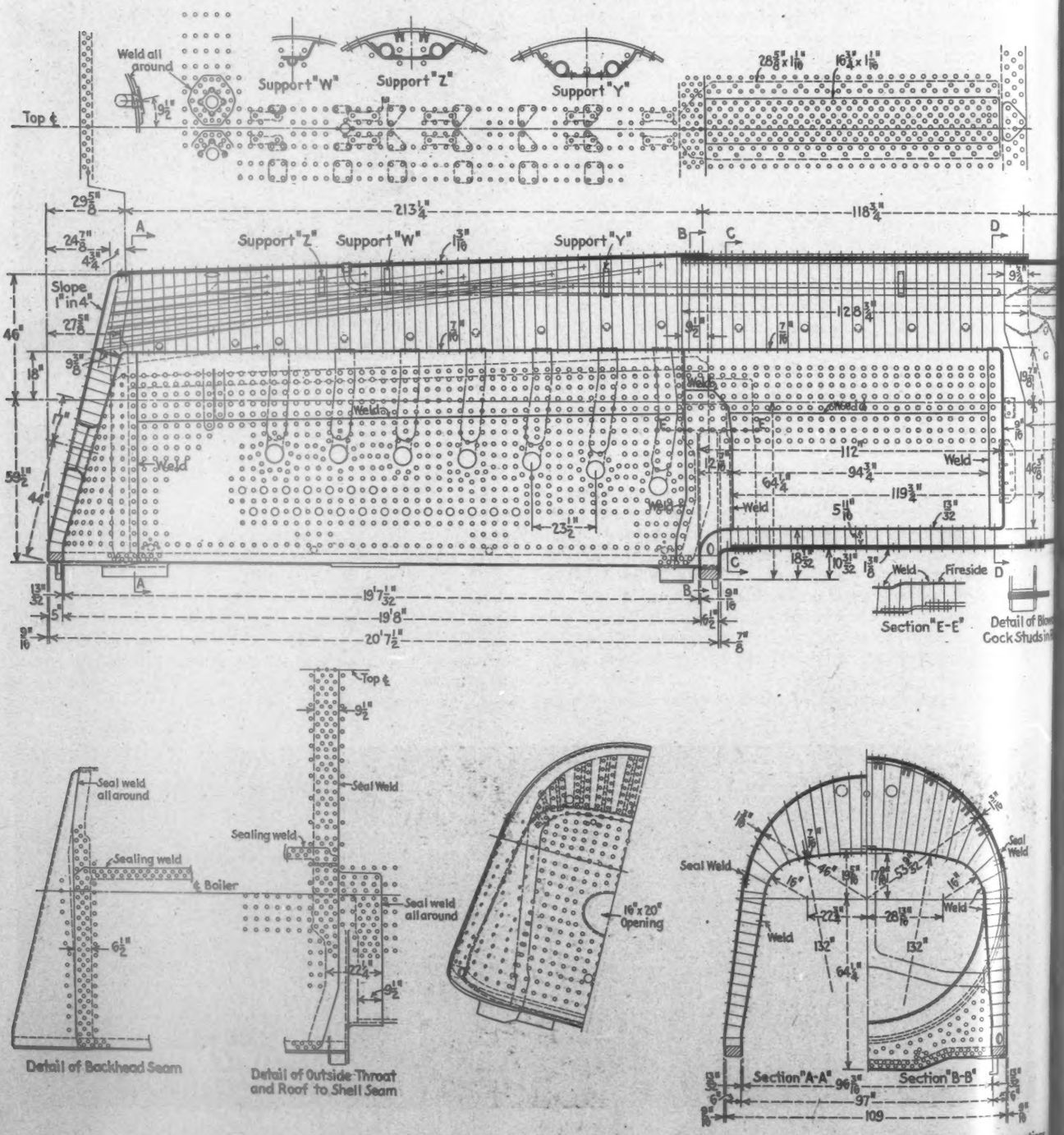
The exhaust-steam injector is the recently developed type TP. It is started and stopped by a simple starting valve. The amount of water delivered to the boiler is regulated by an indexing handle in the cab which is the only manual control and does not need to be moved when the injector is shut off. The operation is entirely

The rear engine unit in the erecting shop

automatic once the starting valve is opened. The centrifugal booster pump is added to the type TP injector so that the choice of location on the locomotive is not limited by the non-lifting characteristic of the injector itself, and on these locomotives the exhaust-steam injector is located on the left side of the smokebox.

The Type E superheater has 93 units. These units, which are inserted in 4-in. flues, are 1⅜ in. in diameter. The multiple throttle includes an auxiliary throttle, supplied with saturated steam from the dome, for drifting and handling the locomotives by hostlers at terminals. The throttle has a double quadrant and latch to permit half-notch adjustment. It provides additional head room.

The front-end arrangement consists of two complete stacks and exhaust nozzles on a common base, one for each of the two engine units. Each exhaust tip has four jets. Each stack extension includes a four-jet combining tube at the bottom which resembles somewhat the formerly much-used petticoat pipe in its relation to the stack extension proper. These jet-combining tubes comprise in effect four draft tubes, one for each exhaust jet, and the setting is such that the jet fills the tube near the top. As the exhaust jets pass into the upper part of the stack extension, further injector action is effected in the annular passage between the top of the draft tubes and the stack-extension bell.

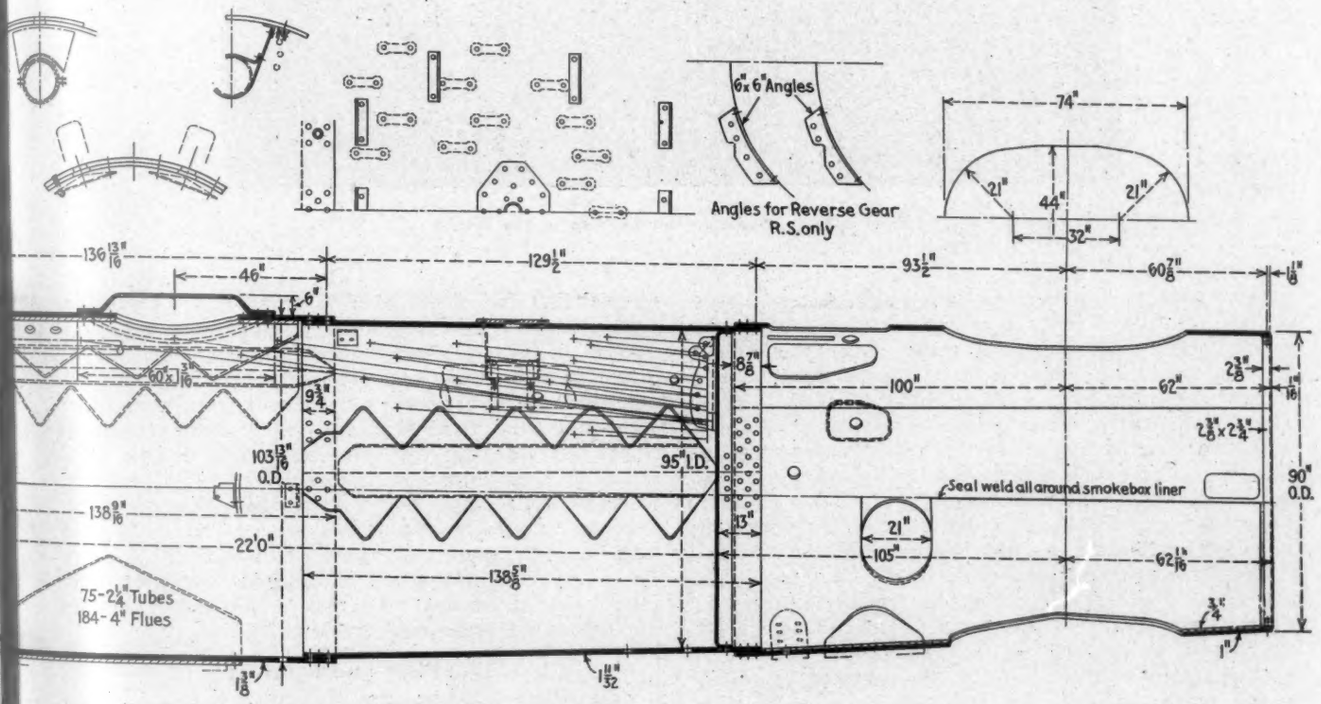


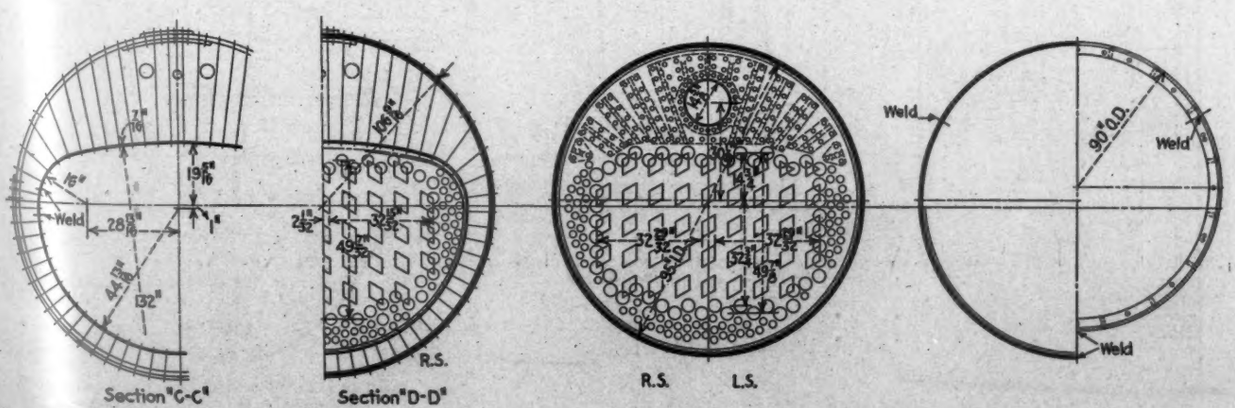
The labyrinth front-end draft appliance is a patented device developed on the Union Pacific. Instead of the customary arrangement of table plate, the exhaust nozzles and smoke stacks are enclosed at the sides by longitudinal sheets which slope from the arch of the smokebox to the top of the exhaust stands. Thus, the gas passages to the front of the smokebox range from 96 to 112 per cent of the net gas area through the tubes and flues.

The front of the space about the stacks and nozzles is partially closed by a vertical plate, the top of which is 22¼ in. above the center line of the boiler. The gases pass through the space between this plate and the smokebox door and over its top through the area between it and the top of the smoke arch through the labyrinth draft appliance. The areas of these passages are in excess of the net gas area through the tubes and flues.

The cab is completely supported from the boiler. It is insulated with Fiberglas and lined with Masonite. It has Prime clear-vision windows with air defrosters at the front and windshield wings at the windows on each side. Both the engineman's and fireman's seats, furnished by Heywood-Wakefield, are adjustable both horizontally and vertically. There is a seat for the road foreman on the right side, and a seat for the brakeman on the left side.

These locomotives are equipped with two water





d details of the boiler

Seven Security circulators are installed in the firebox

columns each having two standard-length water glasses, and the right-hand water column is provided with three gauge cocks. The height of water above the highest point of the crown sheet on level tangent track is 10½ in. with the water level in the boiler at the bottom gauge cock. Each pair of water glasses is applied with a vertical difference of 5½ in. in the lowest water-glass indication. The upper water glass is for indicating the height of the water in the boiler on level track or ascending grades, and the lower water glass is for indicating the height of the water in the boiler on descending grades.

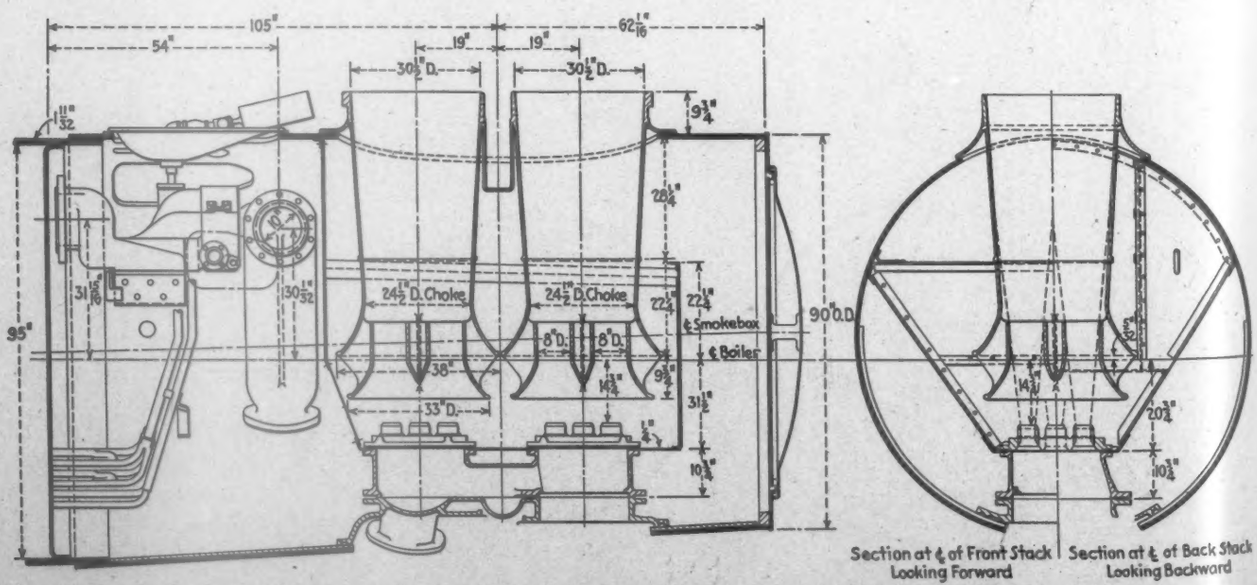
There are two saturated-steam turrets in front of the cab, one on either side. Each is supplied through a 3½-in. dry pipe from the dome. Another turret for superheated steam supplies the air pumps, stoker and turbo-generator. The whistle is also operated by superheated steam.

The air-brake equipment is Westinghouse No. 8 ET. Two 8½-in. cross-compound compressors are mounted on the front end of the forward engine bed. Each compressor is served by a mechanically operated lubricator. Shields in front of the air compressors protect the air-brake fin-tube radiation. There is 15 ft. of radiation pipe between the air pumps and a sump reservoir and an eight-tube New York Air Brake intercooler between the sump reservoir and the main reservoir. In the sump reservoir is an automatic drain valve.

Single brake heads with two flanged brake shoes per head are applied on the driving wheels. A single long brake shoe is applied on the rear of each trailer-truck wheel. The engine truck is designed for the future application of brakes. There are anti-rattler devices throughout the brake rigging.

The Pilot and Bumper

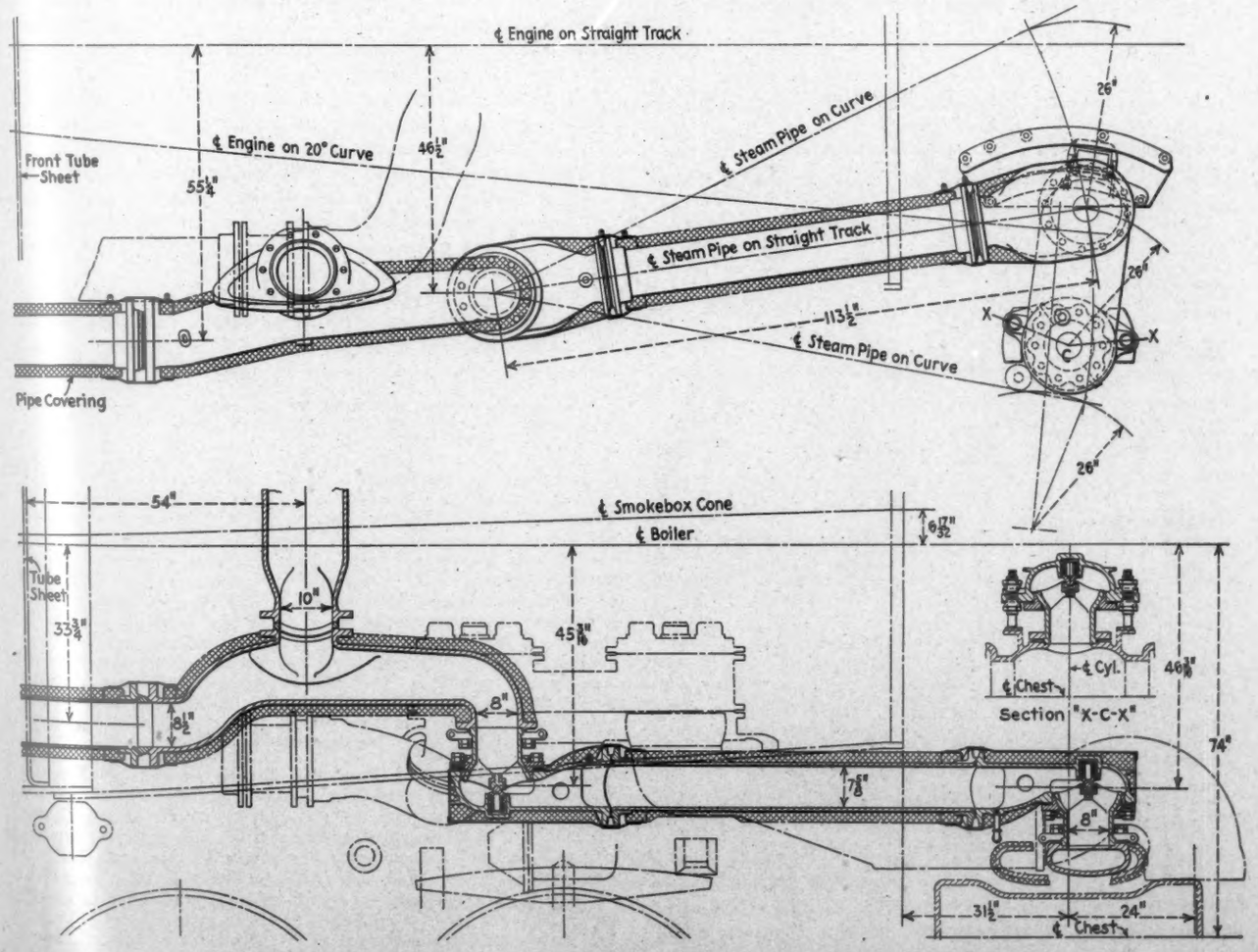
The pilot is cast integral with the front bumper beam and the latter is provided with a rubber bumper. The top section of the pilot consists of a swing-type coupler



In the front end are two stacks, two four-jet exhaust nozzles and a patented labyrinth front-end draft appliance

Partial List of Materials and Equipment on the Union Pacific 4-8-8-4 Type Locomotives

Bases, driving-wheel centers, bumpers and pilots, trailing trucks	General Steel Castings Corp., Eddystone, Pa.
Engine and trailer-truck wheels	Bethlehem Steel Co., Bethlehem, Pa. Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Lateral-motion device; trailer and driving springs; tires	American Locomotive Co., Railway Steel Spring Div., New York.
Radial buffers; frame wedges; compensator and snubber	Franklin Railway Supply Co., Inc., New York.
Roller bearings	SKF Industries, Philadelphia, Pa. The Timken Roller Bearing Co., Canton, O.
Frame equalizer bushings; shaft arm bushings	Gatke Corp., Chicago.
Engine couplers	Buckeye Steel Castings Co., Columbus, Ohio.
Brakes	Westinghouse Air Brake Co., Wilmerding, Pa.
Brake shoes	American Brake Shoe & Foundry Co., New York.
Brake-pipe conduit	United States Rubber Co., New York.
Air pump intercooler	New York Air Brake Co., New York.
Boiler and firebox plates	Bethlehem Steel Co., Bethlehem, Pa.
Tubes	National Tube Co., Pittsburgh, Pa.
Tube turns	Tube-Turns, Incorporated, Louisville, Ky.
Brick arch; Security circulators	American Arch Co., Inc., New York.
Staybolt material	Jos. T. Ryerson & Son, Chicago. Ulster Iron Works, Dover, N. J.
Flexible stays; expansion stays	Flannery Bolt Co., Bridgeville, Pa.
Rivets	The Champion Rivet Co., Cleveland, Ohio.
Fusible plugs	Nathan Manufacturing Co., New York.
Lock washers	National Lock Washer Co., Newark, N. J.
Stop nuts	Elastic Stop Nut Corp., Union, N. J.
Door hinges	The Homer D. Bronson Co., Beacon Falls, Conn.
Steam pipes; exhaust pipes	National Tube Co., Pittsburgh, Pa.
Pipe clamps	Adirondack Foundries & Steel, Inc., Watervliet, N. Y.
Pipe supports	Symington-Gould Corp., Rochester, N. Y.
Copper pipe	Chase Brass & Copper Co., Waterbury, Conn. Phelps Dodge Copper Products Corporation, New York.
Asbestos tubing	Union Asbestos & Rubber Co., Chicago.
Cylinder and boiler lagging	Johns-Manville Sales Corp., New York.
Multiple throttle	American Throttle Co., New York.
Packing	The Garlock Packing Company, Palmyra, N. Y.
Superheater pipes; exhaust steam injectors	The Superheater Company, New York.
Steam line injectors	Nathan Manufacturing Co., New York.
Foam collapsing system	Electro Chemical Engineering Corp., Chicago.
Coal sprinklers	Wm. Sellers & Co., Inc., Philadelphia, Pa.
Ashpan sprinkler valve	The Lunkenheimer Company, Cincinnati, Ohio.
Washout plugs; circulator plugs	The Prime Manufacturing Co., Milwaukee, Wis.
Hose	Hewitt Rubber Corp., Buffalo, N. Y.
Blow-off cocks	Wilson Engineering Corp., Chicago.
Feed pipe strainer	T-Z Railway Equipment Co., Chicago.
Grates	Waugh Equipment Co., New York.
Firedoors	Franklin Railway Supply Co., Inc., New York.
Stokers	Standard Stoker Co., Inc., New York.
Stoker flexible joints	Barco Manufacturing Co., Chicago.
Cab insulation; ventilators	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Cab roof; side walls	Masonite Corp., Chicago.
Clear vision windows	The Prime Manufacturing Co., Milwaukee, Wis.
Shatterproof glass	Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Floor plates	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Engineman and firemans seats	Heywood-Wakefield Co., Gardner, Mass.
Seat covering	L. C. Chase & Co., Inc., New York.
Water gages; gage cocks	Nathan Manufacturing Co., New York.
Safety valves; boiler checks	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Steam-heat gages; back-pressure gages; steam gages	Ashton Valve Co., Boston, Mass.
Steam-heat flexible joints	Franklin Railway Supply Co., Inc., New York.
Gage holders	T-Z Railway Equipment Co., Chicago.
Cocks and valves	Crane Co., Chicago. The Lukenheimer Co., Cincinnati, Ohio. Walworth Company, New York.
Whistle	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Bell ringer	Railway Service and Supply Corp., Indianapolis, Ind.
Sander equipment	Morris B. Brewster Company, Chicago.
Headlights and headlight generator	The Pyle-National Company, Chicago.
Classification lamps	The Adams & Westlake Co., Elkhart, Ind.



There are three ball joints and no slip joints in the steam pipes to the front cylinders

The front coupler is here shown in operating position

Ball joints	Barco Manufacturing Co., Chicago.
Universal joints	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Flexible conductor	Kerite Insulated Wire & Cable Co., New York.
Cylinder and piston-valve bushings; piston valves	Hunt-Spiller Manufacturing Corporation, Boston, Mass.
Pistons	Locomotive Finished Material Co., Atchison, Kan.
Piston-rod and valve-stem packing	Paxton-Mitchell Co., Omaha, Neb.
Rod brasses; hub liners; crosshead liners; eccentric crank liners; expansion shoe wearing plates; frame shoes; bells; steam metal	Magnus Metal Corporation, Chicago.
Crossheads	Vanadium Corporation of America, New York.
Steel for crank pins, driving axles, main and side rods, and valve-gear details	The International Nickel Company, New York.
Drifting valves	Kieley & Mueller, Inc., New York.
McGill needle roller bearings (valve gear)	Pilliod Co., New York.
Cylinder cocks	The Prime Manufacturing Co., Milwaukee, Wis.
Drain cocks	The Okadee Company, Chicago.
Reverse gear	American Locomotive Co., New York.
Lubricators	Nathan Manufacturing Co., New York.
Lubricator dividers and terminal checks	Detroit Lubricator Co., Detroit, Mich.
Alemite grease	Socony Vacuum Oil Co., Inc., New York.
Rod grease	The Texas Company, New York.
Grease fittings	The Prime Manufacturing Co., Milwaukee, Wis.
Tender:	
Frames; lateral-motion device; front truck	General Steel Castings Corp., Eddystone, Pa.
Wheels	Bethlehem Steel Co., Bethlehem, Pa. Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Roller bearings	The Timken Roller Bearing Co., Canton, Ohio.
Clasp brakes	American Steel Foundries, Chicago.
Draft gear	W. H. Miner, Inc., Chicago.
Couplers	National Malleable and Steel Castings Co., Cleveland, Ohio.
Tank plates	Bethlehem Steel Co., Bethlehem, Pa.
Steam-heat pipe covering	Union Asbestos & Rubber Co., Chicago.
Paint	E. I. du Pont de Nemours & Co., Wilmington, Del. The Glidden Co., Cleveland, Ohio. Sherwin Williams Co., Cleveland, Ohio.

furnished by the Buckeye Steel Castings Company, which, when in closed position, fits the contour of the pilot and removes all obstructions.

The Tender

The tenders are built on General Steel Castings water-bottom beds. They are carried on a four-wheel truck at the front end and five pairs of wheels mounted in pedestals cast integral with the tender bed. The equalizing system provides a three-point-load suspension. All wheels are 42 in. in diameter and have Timken roller bearings in outside journal boxes.

The four-wheel tender truck is equalized and has a roller centering device designed for 17 per cent initial and constant lateral resistance. There are no side bearings on the tender truck.

The five pairs of pedestal-mounted wheels are equalized together on each side of the tender, with one semi-elliptic spring and two coil springs over each box. The front and back ends of each equalizing system are anchored to the bed casting through double cushioning coils in tandem. Casehardened spring rigging pins are fitted in Graphitex bushings.

All five pairs of wheels mounted in fixed pedestals are fitted with the General Steel Castings centering device. This consists of rubber blocks, sandwiched between steel plates, which are inserted between the semi-elliptic spring saddles and the top of each box. The vertical guides for the spring saddle on the frame prevent lateral movement of the top of this device but do not interfere with the lateral movement of the journal boxes against the resistance of the shear distortion of the rubber. On the four forward pairs of fixed wheels provision is made for a lateral movement of 1¼ in. On the rear pair of wheels the movement is restricted to ¾ in.*

A Nathan DV-7 lubricator with eight feeds is mounted on the tender bed and driven from the stoker engine. These feeds supply oil to all tender-truck boxes and to the tender-truck center plate.

Between the engine and tender there is a Franklin E2 radial buffer. The engine and tender connections include U. S. armored rubber hose for the air-brake lines; Franklin metallic joints in the steam-heat train line, and Barco flexible joints in the stoker steam connections.

Couplers, furnished by the National Malleable and Steel Castings Company, and Miner A94XB draft gears are installed at the rear of the tender.

The principal dimensions, weights, and proportions of these locomotives are shown in a table. Another shows a partial list of manufacturers whose materials and equipment form a part of the locomotives.

* For a more detailed description of this tender design see "Union Pacific Tenders Embody Many Improved Features," page 386, October, 1940, *Railway Mechanical Engineer*.

SENATE REFRIGERATOR CAR BILL.—The Senate on October 4 passed S. 2753, the so-called refrigerator car bill sponsored by Senator Shipstead, Farmer-Laborite of Minnesota. The present version of this measure would amend the Interstate Commerce Act to give shippers of fresh meats, packing house products or dairy products the right to furnish their own refrigerator cars—provided the railroads were unable or unwilling to supply proper equipment. In other words the right of the railroads to furnish the cars is protected, if they have the equipment. The bill, and a similar measure pending before the House committee on interstate and foreign commerce, was introduced following that May 5, 1939, notice wherein the Car Service Division announced the policy of reserving for railroads the right to furnish railroad-owned or railroad-controlled cars for the traffic involved.

THE BUENOS AIRES & PACIFIC, a British-owned road proceeding west out of the Argentine capital, has recently added 12 Ganz-built rail-motor cars to its equipment roster. Eight of the new cars are to be used for passenger traffic, while the remaining four will be used for express and mail traffic. The cars have a maximum speed of 60 m. p. h. and a normal operating speed of 56 m. p. h. The passenger-carrying units have a seating capacity for 60 persons, while the express cars have a capacity of 10 tons. The latter are so constructed as to permit easy conversion to passenger-carrying facilities if necessary at a later date.

Railroad Division, A.S.M.E., Stages Timely Program

THURSDAY, December 4, will be the date of the Railroad Sessions at the annual meeting of the American Society of Mechanical Engineers which will be held on December 1-5, inclusive, at the Hotel Astor, New York. The morning session, which will begin at 9:30, will be followed by an informal luncheon at 12:30. The afternoon session will convene at 2 o'clock. The program for the two sessions has recently been completed by the Meetings and Papers Committee of the Railroad Division, of which W. M. Sheehan, assistant vice-president of sales, General Steel Castings Company, is chairman, under the general direction of A. I. Lipetz, consulting engineer, American Locomotive Company, who is chairman of the Executive Committee. Other members of the Executive Committee are D. S. Ellis, chief mechanical officer, Chesapeake & Ohio; John R. Jackson, engineer of tests, Missouri Pacific; John G. Adair, mechanical engineer, Bureau of Locomotive Inspection, Interstate Commerce Commission, and First Lieutenant C. L. Combes (secretary), Coast Artillery School, Fort Monroe, Va.

The program for the two sessions follows:

• • •

Thursday, December 4
Railroad I
9:30 a.m.

Symposium on How Can Mechanical Engineering Assist Railroads in Meeting the Transportation Phases of the National Emergency?

Introductory remarks by W. A. Hanley, President, American Society of Mechanical Engineers

Keynote speakers:
W. C. Dickerman, chairman of the board, American Locomotive Company.
C. D. Young, vice-president, The Pennsylvania Railroad

General discussion

12:30 p.m.

Informal luncheon

Railroad II
2:00 p.m.

Railway Progress Report, by E. G. Young, Research Professor, University of Illinois

Forum on The Importance of Standardization of Steam Railroad Locomotives and Freight Cars and Their Greater Utilization in Freight Service

Opened by Ralph Budd, president, Chicago, Burlington & Quincy, and commissioner, Transportation Division of the Advisory Commission

General discussion

Lightweight Steel Coaches

An order of 45, of all-welded steel construction, delivered to the New York Central by Pullman-Standard — Eighty-four-foot cars seat 56 passengers each

THE New York Central has recently received from the Pullman-Standard Car Manufacturing Company, 45 new passenger coaches of all-welded low-alloy high-tensile steel construction, each having a weight of 121,000 lb.

Principal Features of Construction

The car frame is of welded girder design, made principally of U. S. S. Cor-Ten steel and sheathed on the outside with the same type of low-alloy high-tensile steel. While relatively light in gage, this side sheathing is maintained straight and true to an unusual degree by means of closely spaced channel stiffeners ¾ in. deep welded to the inside surfaces. The center sill comprises two A. A. R. Z-sections, 31.3 lb. per foot, with the top flanges joined by a continuous weld. Each side sill includes a No. 10 gage pressed member and a rolled angle. The draft sills are a continuation of the center sills and embody built-up welded construction in combination with cast-steel draft-gear stops conforming to A. A. R. specifications. The side skirts are extended at the lower portion of the sides, curving inward to complete the streamline effect and are cut away at the trucks. Hinged sections give access to underneath equipment. The roof sheets are No. 18 gage alloy steel with Z-shape reinforcements welded to the underside.

The flooring is Pullman arch-type, made of galvanized steel with Tuco light-weight floor composition applied over it. The car insulation consists of Fiberglas with latex covering, and is 3 in. thick in the floor and roof and 2½ in. thick in the sides and ends.

Draft gears are the Waughmat twin-cushion type, with National A. A. R. tight-lock couplers, having a two-pin universal connection, with cast-steel yokes. Pullman type trap doors operate in conjunction with pivoted retracting steps having Kass 1/16-in. stainless-steel treads. The Pullman-Standard vestibule closure arrangement, conforming with the exterior contour of the car body, has anti-rattling supports, bracing attachments, facings, etc., and a center, top and bottom buffer stem with single coil spring. The center and outside diaphragms are made of canvas and stretched rubber, respectively.

The interior finish of the car consists of the following: wainscoting, 3/16-in. tempered Presdwood; pier panels, .048-in. furniture steel; frieze panels and end finish panels, 3/16-in. tempered Presdwood; partitions, ½-in. Galvanneal-covered plywood; moldings of chrome-finish steel, snap-on type; ceilings, furniture-grade steel. The doors in the car ends are of hollow-type sheet-steel

The end wall surfaces are finished with linoleum—The rotating reversible seats have individually adjustable backs—Folding foot rests add to the comfort of the end seats

One of the coaches recently built by Pullman-Standard

construction; vestibule doors are of copper-bearing steel, with Pullman two-part construction. End door locks are of the Dayton Push-Pull type, the end doors also being equipped with Russell & Erwin semi-concealed door checks with open-holder feature.

Window sash throughout are stationary and consist of Edwards double-glazed dehydrated units, with ¼-in. polished plate glass on the outside and ¼-in. polished laminated glass on the inside. Dayton continuous type basket racks and lighting fixtures in combination are installed. They are approximately 18 in. wide and 51½ ft. long on each side of the car. One lighting fixture is located over each seat, individually controlled. The racks have a nose piece of steel satin chrome finish and the balance is painted the same color as the frieze panels.

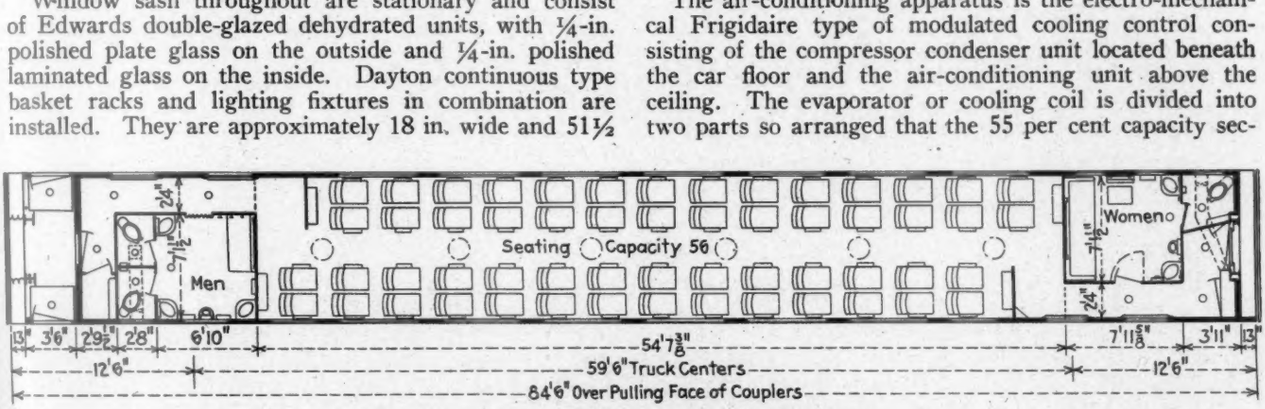
In conjunction with the general lighting scheme six combination air outlet and lighting fixtures are located in the ceiling spaced symmetrically on the longitudinal center line of the car. These fixtures are arranged with two lamps, one for general illumination and one blue lamp for night lighting.

Exhaust fans are installed, one at each end of the car; they are located over the ceiling in the toilet rooms. Exhaust ducts extend to the lavatory and toilet and at one end of the car, to the regulator locker. These fans are electrically controlled through the blower-fan-control circuit breaker so that the blower fan and exhaust fans operate at the same time.

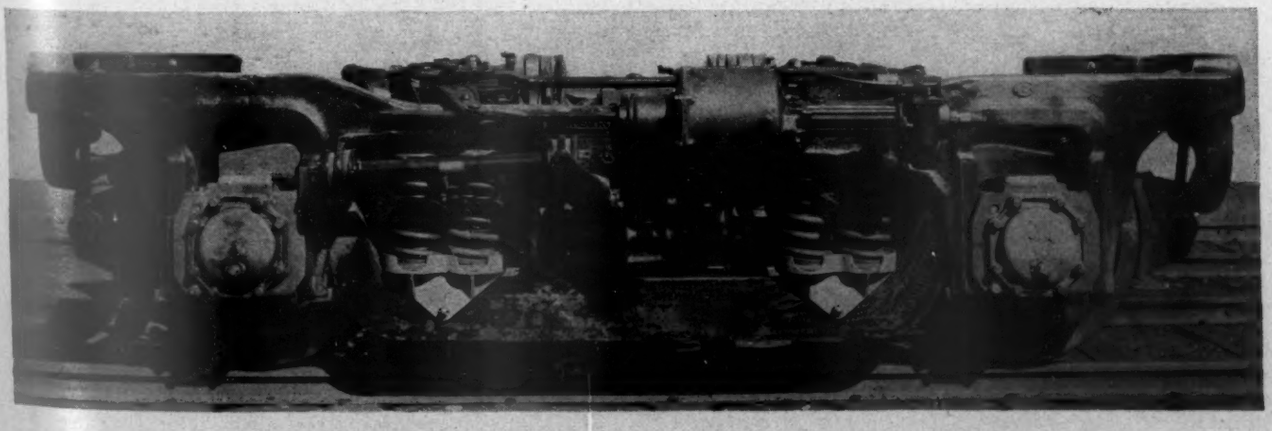
Air-Conditioning and Lighting Equipment

The air-conditioning apparatus is the electro-mechanical Frigidaire type of modulated cooling control consisting of the compressor condenser unit located beneath the car floor and the air-conditioning unit above the ceiling. The evaporator or cooling coil is divided into two parts so arranged that the 55 per cent capacity section of the evaporator cycles under the control of a differential thermostat and the 45 per cent capacity coil operates continuously with control to limit the low temperature by cycling of the compressor.

Insulated ducts conduct the conditioned air to Aerofuse combination air outlets and lighting fixtures located at the center line of the ceiling. The floor heat control panel is of the Vapor type, as is all other steam-heat equipment, including copper unit-fin type radiation and thermostatic control, on 20 of the cars. On 25 cars, this equipment is of the Fulton-Sylphon type. Vapor end valves and couplers are installed, with Barco horizontal-type insulated steam-heat connectors. The train line consists of 2⅝-in. inside-diameter seamless



Floor plan of one of the New York Central coaches



The single drop equalizer trucks are fitted with coil bolster springs and shock absorbers

steel tubing. Wovenstone insulation is applied on all steam pipes and fittings under the car.

Lighting equipment consists of a General Electric 20-kw. 80-volt generator and a 15-hp. 220-volt, three-phase induction motor, assembled as one unit and mounted on the car body with resilient mountings designed for proper weight distribution. The generator unit is driven by a Spicer drive equipped with an automatic clutch. Suitable a.c. standby receptacles permit the air-conditioning equipment to be operated at stations and terminals, and d.c. charging receptacles are available for charging the Gould 32-cell 600-amp.-hr. batteries. Lamp regulators are of the Safety carbon-pile type, with the regulator set at 60 volts at the center of the lamp load.

Air brakes are the New York Schedule H. S. C. with D-22 control valves, providing for the future application of electro-pneumatic and speed-governor control. Two 12-in. by 10-in. cylinders per truck are installed with an automatic slack adjuster for each cylinder. The hand brake is Peacock.

Details of the Truck Construction

The trucks are of the General Steel Castings four-wheel, single drop-equalizer type, with a 9-ft. wheel base. Simplex unit-cylinder clasp brakes are installed and designed to develop 250 per cent braking power when needed. The bolster and equalizer springs are of the coil type supplied by the Crucible Steel Company. The axles, with 5½-in. by 10-in. journals, are designed for the application of roller bearings, 35 of the cars being equipped with Hyatt bearings and 10 with Timken roller bearings. All journal boxes are supplied with stench bombs to warn of overheating. The Carnegie-Illinois wheels are 36 in. in diameter, solid wrought carbon-steel type with 11-in. hubs and toughened rims.

The truck center pins are of the Miner locking type, 4 in. in diameter, roller side bearings also being of the Miner type. Shock absorbers on all trucks are of the one-way vertical type. Houde shock absorbers are used on 25 cars and Monroe on 20 cars.

Sound deadening pads consist of bolster stops made of rubber vulcanized to steel plates, spring-plate stabilizing cushions of the same construction and equalizer-spring sound-insulation fillers made of Fabreeka. The truck center plates are of cast steel, machined on the inside, at the bottom bearing surface, and at the flange edges to fit between retaining lugs on the bolster. The center plates are sealed to dust and lubricated.

The Interior Facilities

The main passenger compartment in the center of the car, slightly over 54½ ft. long, has 28 double rotating reclining seats, spaced at 3 ft. 5½ in. centers and giving a total seating capacity of 56. An 8-ft. women's lounge in one end of the car has a four-seat sofa, a dressing mirror and table, and the usual complement of toilet facilities. The men's room in the other end of the car is 9½ ft. long and includes a two-seat sofa. Two toilets adjoin the men's room.

The double rotating reclining seats, supplied by the Coach & Car Equipment Company, have foam rubber cushions and folding foot rests. The Massachusetts mohair plush seat covering is turquoise in color with horizontal stripes. The sofa in the men's lounge, made by Karpen Brothers, embodies spring and hair construction with a reddish-tan leather seat covering. In the women's lounge the Karpen full-length sofa has a two-piece seat cushion with one-piece back.

Long mirrors are installed on the toilet entrance doors and wall mirrors at the washstands in the lounge rooms. On the bulkheads in the main passenger compartment mirrors are set in 26-in. by 36-in. metal frames. An electric water cooler is installed in the car with the overhead cooling unit located above the ceiling in the women's lounge and the water-spigot alcove built into the low bulkhead at the women's end of the car.

The decorative treatment and color scheme for these coaches was developed by Henry Dreyfuss. The colors range from deep tones of egg plant at the bottom through rust to gray with blue-green upholstery. Linoleum is used as a wall covering for the end partitions.

The new coaches are designed with a coupled length of 84½ ft.; length, center to center of trucks, 59½ ft.; height, rail to roof, 13½ ft., and width over side sill, 10 ft. Each car body weighs 81,600 lb., and the two four-wheel trucks, 39,400 lb., or a total of 121,000 lb.

* * *

Diesel-electric passenger locomotives of the F. E. C., A. C. L., S. A. L., Southern, and B. & O., respectively, lined up at Washington, D. C. —Built by the Electro-Motive Corporation

How to Have

Effective Safety Meetings*

By L. G. Bentley†

Experience of the Chesapeake & Ohio with Safety Committee organization and methods of conducting meetings — Employees and supervisors both active in the work

I HAVE little or no knowledge of the manner in which safety meetings are conducted on other railroads. I do know how they are conducted on the Chesapeake & Ohio and you will therefore pardon my seeming partiality to the type of meetings we have found most effective, without material change for the past 28 years.

I prefer to be specific rather than general, and for that reason I shall describe a meeting held at Huntington, W. Va., on September 11, upon which occasion I was a visitor and because of my attendance and to enable me to speak to them jointly, four committees were consolidated into one meeting.

These committees were from the locomotive and car department, terminal shops, and stores department.

The attendance comprised 11 supervisors, 22 rank-and-file men, 10 apprentices and 21 visitors. One representative was present from each shop craft on each committee.

In the mechanical department, the representatives of the rank and file are chosen through nomination by the appropriate labor organization of two candidates, one of whom is selected by the chairman. The terms of supervision are permanent and of the employee representative, one year. All meetings are bi-monthly and on company time.

The divisional and terminal meetings consist of a considerably larger proportion of supervisory officers with the ranking divisional officer as chairman and a representative from each of the labor organizations proper to be in a divisional or terminal committee.

Employee members in the shops and stores are taken from their work for the length of time necessary to conduct the business of the meeting and they then return to their regular work without loss of pay.

In the divisional meetings if necessary to relieve employee representatives from their regular work, this is done, and they are paid in full for any time lost and reimbursed for necessary expenses.

I think you will get a better picture of committee organization and activity from the order of business.

Attendance is compulsory unless prevented by illness, death, attending court or other unavoidable causes; being "assigned to important duties" is not an excuse.

No substitutes for absentees are permitted as the regular members are carefully selected and expected to take active part in the work, particularly between meetings.

Unsafe Practices Reports

Committee members are giving special attention to the correction of unsafe acts and presentation of these reports is the first order of business.

Each committeeman is furnished a book containing five unsafe-condition reports and 20 unsafe-act reports. We call the unsafe-acts reports "yellow slips" and an example of the manner in which they are used is the following slip turned in by a machinist on the day the act was observed:

On September 5, 2:40 P. M., in the electrical shop, I observed Machinist Bode Wilkins standing unsafely near and walking under engine truck being lifted by overhead crane. I spoke to him regarding this act and he promised that it would not be repeated.

At the particular meeting to which I refer, the committee members turned in a total of 391 of these reports.

Our instructions as to the manner of handling these reports are that a few hours before the meeting is called the secretary shall organize the yellow slips and report on them in summary.

A section of the secretary's report follows:

Standing unsafely near material being lifted, two reports by Messrs. O'Connor and Bias.

Using hands to clean chips from machinery and drills, one report by Mr. Hinerman.

Throwing or dropping material from overhead, two reports by Messrs. Hinerman and Bias.

Leaving tools, material or rubbish in aisles or passageways, eight reports by Messrs. Bostic, O'Connor, O'Neil, Greene, Hinerman and Diehl.

Using tools or machinery in an unsafe manner, thirty-one reports by fourteen separate members of the committee.

The efficiency of handling these reports in this manner is seen in the fact that the entire 391 unsafe practice reports were reviewed impressively in a period of 15 min.

We require supervision to give the name of the employee observed. Employee members are not required to give names but are encouraged to do so, and are gradually understanding the importance of this feature and are giving the names.

A boilermaker, in meeting, recently submitted a yellow slip reading like this: "On August 21, in the machine shop, I observed three apprentices, using compressed air to blow dust off their clothing. I corrected them and was surprised to know that none of them knew of the danger of this act."

Discussion of this report developed that there were several members of the committee who were also ignorant of the purpose of the rule prohibiting this practice. This adds value to the use of unsafe-practice reports, as each member of the committee is refreshed as to the rule and its purpose.

No discipline is applied to any one observed by a fellow employee and covered by such a report.

In advance of each meeting, the secretary prepares the unfinished business in such form that he can speedily cover this feature, giving the status of each suggestion which was outstanding at the last meeting and, if

* Paper presented at a meeting of the Steam Railroad Section of the National Safety Council, held at Chicago, October 7 to 9, inclusive.
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necessary, inquiring of the originator as to its status.

The secretary prepares in advance a statement of suggestions received and handled since last meeting. This statement includes the suggestion in full together with the action taken thereon. If advice is required as to further attention, it is secured from the proper member of the committee when this report is read.

The four committees in question, during the nine months ended September 30, 1941, turned in a total of 421 suggestions of which 396 were corrected promptly, only three were found improper, while but 22 were pending at the end of the period. This speaks eloquently for the reasonableness and the good judgment of the committee members and for the promptness with which management is disposing of these matters.

If for any reason a suggestion is declined, a personal letter is written by the chairman to the originator of the suggestion, in which proper explanation and expressions of appreciation are made.

In the shops, an Inspection Committee of two members, alternating from time to time, is sent out during each week without warning and required to spend one hour inspecting. During the nine months in question, inspection committees, representing the four safety committees under discussion, devoted 221 hours to this work and turned in a total of 246 suggestions, which was a substantial part of the total of 421 turned in by the committees as a whole.

Discussion of Accidents

The committee we are discussing was in session 1½ hours, of which time one hour and twenty-five min. were devoted to accident prevention discussions and 5 min. to a discussion of accidents that had occurred during the last two months.

Lest you get the idea that the large number of unsafe practice reports made by committee members at this meeting indicates an extremely careless, dangerous operation, I hasten to correct this impression as there has not been a reportable injury in this entire plant this year, although nearly three million man hours service have been performed.

The facts are that an organization of supervision and safety committeemen can enter any of the shops on our railroad, and I believe on any other railroad in the United States, and if they are as keenly alert as intensively interested in accident prevention as the members of this particular committee are an equal or greater number of unsafe-practice reports will be brought to light.

By means of a monthly circular which we call our "Safety Digest," the chairman of the committee then makes a report as to progress. As a matter of fact, however, the interest in this particular shop is so keen that almost everyone knows the status of the organization in connection with their accident record.

For the nine months period, this committee received a total of over 2,000 unsafe-practice reports. The entire cost of taking these men from their jobs and consulting with them as to accident prevention measures amounted to $151.60, or an average for the 22 rank and file committeemen of $6.80 each for nine months work.

An important feature of the efficiency of this committee is seen in the fact that both the reports of unsafe conditions and unsafe practices are submitted by the committeemen between meetings so that immediate action may be taken thereon.

As to the expense for holding safety committee meetings over the entire system, in accordance with our plan of paying committeemen for their lost time and expenses, I find that in nine months 173 safety committee meetings were held; the attendance consisted of 1,306 officers and 1,001 employee representatives, and the total expense on all accounts amounted to $2,357.95.

If you can show me a plant by which $2,357.95 can produce a better spirit of cooperative endeavor than that which is clearly demonstrated by our safety committees, I would like to know of it.

As I thought about this subject and as I reviewed our past experiences and prospects for future progress, I thought of three lines taken from Tennyson's "The Charge of the Light Brigade"—

"Their's not to reason why
Their's not to make reply
Their's but to do or die."

I am not at all sympathetic to a plan that seeks cooperation of the worker through fear of punishment, nor by a totalitarian method of conducting the program.

In further expression of this conviction on my part, I feel justified in quoting from my remarks at New Orleans, La., last May when I spoke on "The Future of The Safety Section."

"The rank and file of employees are those who have the greatest stake in the safety movement, because they are those who suffer most when an injury occurs, and because they have this stake they should have a distinct and active part in the prevention of accidents.

"We have found our safety committees, comprising officers and employees, great builders of esprit de corps, not only in safety but also in reaching a better understanding between officers and men as to matters of other mutual interests.

"Safety rules and their enforcement have become a necessary part of a good safety organization, but unless the individual rank and file employee in some way has a part in the safety program, he will daily commit acts of hazard that cannot be defined or covered by a safety rule.

"In carrying out a desire to win the active support and cooperation of a person, no better way can be found than to give him something to do. I am sincere in saying that the rank and file of employees must be given a faith in the integrity of our safety program, must believe that it is in their interest to enter that program actively, and the only way that they can be given this conviction is to give them a part in the work."

* * *

Courtesy of W. Curtis Montz

The "Black Diamond" near Ransom, Pa., on the Lehigh Valley

The Cure for

Plugged Front-End Nettings

Report of a committee presented before the Railway Fuel and Traveling Engineers' Association in September relates unsuccessful attempts to determine the cause, but is in no doubt as to the cure: get rid of the netting

THE Committee on Stopped-Up, Plugged, or Slagged-Over Front-end Nettings, Cause and Cure of the Railway Fuel and Traveling Engineers Association, of which H. L. Malette, road foreman of equipment, St. Louis-San Francisco, was chairman, made a collection of opinions as to the causes of plugged front-end nettings which were not at all in close agreement. It also reported on a series of standing tests conducted on the St. L.-S. F. by the chairman, in which attempts were made to reproduce conditions which were thought to have caused front-end nettings to become plugged in service. These tests included several combinations of conditions of the fire with varying sequences of heavy and light firing and of open and closed throttle, and with water sprayed into the front end. In none of the tests, however, was a case of plugged front-end netting successfully induced.

The tests were run with a washed nut coal with not over 10 per cent of fines less than ½ in. It formed coke banks but would not clinker, not even when the fire was stirred with the hook. The coal was low in ash.

The report then undertakes to set forth the conditions and sequence of operations which are believed to cause plugged netting, even though it is impossible to plug the netting artificially by attempts at reproducing these conditions, and then discussed the cure on which the report speaks much more positively than in the attempt to explain the cause. These two portions of the report appear in abstract below.

What Causes Plugged Front-End Netting?

Front end defects contribute to the plugging up of nettings only because they are the factors that caused the engine not to steam as freely as it should. This then leads the fireman to crowd his fire to maintain steam pressure. The crowding of the fire results in a bad fire condition, such as banks or clinkers, with poor distribution of air through the fire bed, causing the draft to be excessive through some parts; or if no banks or clinkers, the firebed will be too heavy, resulting in heavy distilling off of the volatile gases, which will lack oxygen to burn completely when the throttle is closed or eased into drifting position. These will be carried over through the flues into the smoke box with the fine, dusty ash and cinders and when entering the lower temperature zones in the smoke box, they will condense back into a tarry liquid or plastic state.

When condensation of these gases takes place, countless minute drops form throughout the gas. These become larger as the gases shrink and the drops are drawn together. Some of the tar strikes and clings to the netting, picking up more tar, ash dust, fine cinders and soot, building up and closing over the netting. Larger cinders become imbedded and wedged in this deposit and are held there by the draft. Water cannot exist as a liquid in temperatures and vacuums present in the smoke box but is steam and is not what causes the netting to plug up. This condensation of tar does not start to form over the netting at all points at the same time; it starts at the coolest part, which is at the top of the smoke box out of the direct flow of the hot gases entering the smoke box. This point is at the top ahead of the stack where the netting is attached. This accounts for the netting always plugging over at the top first and progressing down; as the netting covers over, it retards the draft and cinders cannot be carried up to the netting and they pile up and fill the front end ahead of the table plate and nozzle below the netting.

Now all this has so reduced the draft that maximum steam pressure cannot be maintained and the front end will have to be opened and cleaned, resulting in a delay. When the front end is opened it will not be a sticky substance you will find as the tar soon hardens to a brittle sort of pitch covered with ash, soot and cinders. It has a dull, charred appearance. Strike the net netting a blow with a hand hammer with the blower closed and it is dislodged and falls down, leaving the netting clean.

This condition can start in a different manner. We will say some defect has made the engine steam poor and the fireman has crowded the fire, or he has no defect but the coal supplied was wet and hard to distribute, and banks and clinkers form; the draft becomes heavy in spots and particles of unburned coal are pulled off the banks or are taken up with the excessive draft, partly burned, and pulled over the arch, through the flues and into the smoke box in a plastic state, sticking to the netting, where the temperature of the smoke box further distills off the lighter volatile gases, leaving the fixed carbon with some of the heavier gases cooled down to a solid brittle tar or pitch. Now this occurs where the coal is a coking coal. We have all seen coal that swells up as it burns, or cokes. The heat is roasting out the volatiles. During this roasting out, a gas or coking coal does become plastic and sticky. Under conditions such as this there is also ash dust, fine cinders and soot forming on and around the cinders on the netting, closing off the draft and lowering the firebox and smoke box temperatures, resulting in a condition being set up where unburned gases condense and complete the plugging.

"Sweating" occurs as the fire is built up in a cold engine or one that has stood with low steam pressure, and the front end sheets, stack and netting are cool; the fire is built up heavy, with blower pressure low, the coal is high in moisture or wet. Under these conditions the fire burns red and smoky, the boiler takes up as much heat as possible, the smoke box gases are at a lower temperature than usual; the water in or on the coal becomes steam but condenses back into water when it comes into contact with the cold front-end parts. In all coals there is some sulphur. The water vapor and steam condensing takes up considerable of the sulphur

vapors. As the drops form on the top of the smoke box and get heavy, they break away and roll or flow down the netting through a path of soot, ash dust and fine cinders, which, being dry, will quickly absorb water and a thin, ash liquid is formed that bridges over the opening between the meshes of the netting, closing off the draft until there is only a small percentage of the netting open, usually at the bottom where the gases pass through at a temperature that will keep the water in the form of steam while passing through and out the stack.

As the pressure in the boiler raises or the front end sheets warm up, and blower pressure becomes stronger, the sweating stops and the front end dries out, but left on the netting is the soot, cinders and ash dust, closing over and restricting the draft. Now a condition is set up which causes a poor steaming engine, the fireman crowds the fire, and as explained before unburned gases, carrying over tar, complete the job started by the sweating and a front end needs cleaning.

The same conditions can be set up that were started by sweating; that is, when an engine has stood with cylinder cocks closed or channels not drained, and valves and cylinders cold, in first starting the engine, if this water has not been blown out the cylinder cocks and the cylinders and valves warmed up, the first few exhausts on starting the engine will not be strong enough to raise the water up and out the stack. The water runs over the top of the nozzle tip into the smoke box, where it evaporates into a highly saturated steam which condenses at the top of smoke box and runs down the netting. Or, the same conditions can be set up where house blowers are not drained before being turned on at the engines, causing water vapors highly saturated to condense on the netting, with results as explained above.

The Cure

The cure-all that is really a cure is to remove the cause; that is, the netting. There are front ends now on the market that do not use nettings, and I am told they are very successful; in fact, I have had experience with two of them.

Second: Teach the roundhouse forces such as firebuilders, engine watchmen and hostlers to avoid having any accumulation of water enter the smoke box when firebox and front end temperatures are low; to drain house blower lines before using, opening cylinder cocks and cracking throttle, and to always reverse the engine a couple of times with the throttle cracked before moving to insure that all water has been expelled and valves and cylinders are warm; not to force fires, making dense smoke, but to build fires and fire so as to keep down smoke with as bright a fire as possible.

Third: Enginemen should be taught to cooperate with each other and avoid wasteful firing practices by keeping fires free of banks and clinkers, supplying fuel to the fire bed only as it is needed. Grates should never be shaken while the engine is working heavily, nor should heavy banks of green coal be stirred up with the rake while the engine is working heavy. If a fireman knows his job and has been observant he can quickly tell, when using the blower with the throttle closed, by the condition of the fire at the time and the amount of blower being used, the length of time it takes to raise pressure under normal conditions. If the fire is average and the blower used is heavy, and steam pressure lags and raises slowly, it is an indication to him that some restriction to draft has occurred. It will be in the front end—the netting partly stopped up, or a bad leak in blower line in the front end, or a unit leak with front end throttle—but this can be tested by closing the blower, with the throttle closed, and a leak sufficient to affect the steaming can be detected by sound. Many times a change in front-end design, sealing of arches, change of grates or the installing of a hot-water wash-out plant has cleared up a division that had trouble of this nature.

My own opinion, and not the opinion of the committee, is:

On the modern locomotive with large grate areas on which the coal burned does not exceed 180 to 200 lb. per sq. ft. per hr., having combustion chambers and flues longer than 17 ft. with arches sealed at bottom and of the proper height so that the flameway or path is long, with grates that will produce an even distribution of air and not require banks to keep the fire on certain sections of the grate, a netting is not required, as the cinder that the draft can raise up and carry over the arch through the high temperatures of the combustion chamber will pass through the flues smaller than the size of the mesh in the average netting. If the cinder isn't smaller, then you have a wasteful engine, high in stack losses or improperly drafted, fired or operated.

Discussion

J. Fahey (N. C. & St. L.) inquired whether the plugging of netting might not come from leaks in the hot-water down pipe from the front-end feedwater heater. The author answered that the feedwater heater pipes are in a recess quite separate from the smokebox.

S. R. Tilbury (A. T. & S. F.) said that plugged netting had formerly been a prolific source of delays. He said that this condition usually arose when the locomotive was about half way over the road, and that it occurred more frequently with good nut coal than with other fuels. He said that they had never succeeded in reproducing the conditions which caused the netting to plug. In no case, he said, had leaks been found in the front end of engines on which the netting had plugged and he also called attention to the fact that the feedwater heater pipes are in enclosed recesses entirely outside the smokebox space.

He cited one situation in which it was customary to shake the grates immediately after changing engine crews and while working the engine hard at about 20 miles an hour up a heavy grade. While this practice was followed, steam pressure would immediately drop back and it would be necessary to clean the front end and the netting, after which the trip would be continued successfully. He said that stopping this practice had overcome the difficulty.

Mr. Tilbury cited other specific instances of trouble from plugged front-end netting. The cure, he said, is the elimination of netting from the front end and stated that a satisfactory front end without netting had been developed by the Santa Fe test department.

A speaker from the New York Central told of both standing and road tests in which efforts had been made to cause front-end netting to plug up by the admission of water to the front end through a ½-in. hose connection. He said that throughout the range of tests in which varying amounts of water were admitted no trouble had developed. He also cited instances in which efforts had been made to reproduce the other conditions which on one trip had caused the front-end netting to become plugged but without success.

In closing, Mr. Malette emphasized, what had been stated in the report, that, with front-end temperatures of 500 deg. F. and higher, and a high vacuum, water can exist in the front end only as superheated steam and that it is not the cause of plugged front-end netting. He admitted frankly that he was still in the dark as to the real cause.

EDITORIALS

Safety Efforts Worth Paying For

Although nearly three million man-hours service were performed during the first nine months of this year in the Huntington, W. Va., shops of the Chesapeake & Ohio, there was no reportable injury. There must be excellent reasons behind a record of this sort. L. G. Bentley, general safety agent of the system, told how it was accomplished in an address before the Steam Railroad Section of the National Safety Council meeting in Chicago last month. His address is reported elsewhere in this issue.

In the first place the Chesapeake & Ohio has persistently and consistently carried on an aggressive safety program for many years. The organization is not only safety conscious, but the movement is so organized that the committees are continually on the job. No excuse, for instance, will be accepted for absence from a committee meeting unless it is absolutely unavoidable. More than that, the committee members at the shops hold their safety meetings during working hours and not on their own time or at their own expense. Employee representatives relieved from their regular work to attend divisional meetings, are compensated for the time lost and are reimbursed for necessary expenses. The railroad, however, feels more than compensated for this expenditure by the savings resulting therefrom.

While the railroads in general have greatly improved their safety records over the years, there are still too many accidents to employees. Some roads consistently maintain splendid safety records; others are just about as consistent in remaining near the bottom of the list, or far from the top. If some roads can do a good job in this respect, why not all of them?

President Roosevelt, when he recently issued a proclamation calling upon the National Safety Council to mobilize the safety forces to reduce accidents in this country, directed attention to the fact that in the year 1941 100,000 lives will be lost because of accidents. Moreover, hundreds of thousands of people will lose a considerable amount of time from their occupations because of accidents, or they may be permanently maimed.

Colonel John Stilwell, president of the National Safety Council, has estimated that the economic loss due to accidents in the year 1941 will approximate three and a half billion dollars. The effect of accidents on our national defense program, in which railroad transportation is intimately involved, is an exceedingly serious factor.

It is, of course, unfortunate to have to make an appeal for safety on an economic basis, when so much suffering is involved and humanitarian instincts should govern. The economic measuring stick, however, does give some idea of the tremendous losses suffered in that category, and with humanitarian objectives, should spur us on to the greatest possible endeavor to reduce and eliminate accidents.

Prize Competition Commended

The announcement in the October *Railway Mechanical Engineer* of the contest for the best articles on ways and means of improving the mechanical department's operations or practices to increase production and secure a larger use from the equipment and facilities, has met with a fine reception on the part of railroad mechanical department officers. Some of them have indicated a desire to publicize the contest on their own systems, and requests have thus far been received for about 4,500 copies of the announcement for distribution by these officers. Such action and co-operation speak for themselves.

Some questions have been asked about the contest. For instance, one man has in mind describing certain improvements he has made in shop practices, which have resulted in increased production and lower unit costs. He wants to know if such an article would be acceptable. Naturally the time element is involved. Will the improvements he has in mind bring about fairly prompt results, or will it take a long time to realize their full value? We are in a period of national emergency and the sooner results can be obtained the better. That factor obviously will be involved in the judges' decision.

Should photographs and drawings accompany the article? Yes, particularly if they are necessary to make the suggestions clear.

The contest closes on January 15, 1942.

Flexibility and Stability In Articulated Locomotives

The problem of adapting the long driving wheel bases of steam locomotives to track curvature has been the subject of a variety of treatments during the history of steam locomotive development. In early attempts at utilizing long coupled wheel bases, wide-faced flangeless tires were applied to the main and intermediate drivers with flanges on the end pairs of wheels. Then came the use of varying gage distances between the backs of the flanged tires on the several pairs of wheels to provide for greater lateral movement of the end pairs of driving wheels within the track gage. This and the

free lateral movement of the axles in the driving boxes permitted the adjustment of eight and ten coupled wheel bases which kept the locomotive on the track even though it did not provide for smooth movement of the locomotive around curves.

About 25 years ago the idea of providing controlled lateral movement of the locomotive axle against a predetermined resistance in order to reduce the length of the rigid wheel base to an amount less than the length of the coupled wheel base was developed and utilized on locomotives with both eight and ten coupled wheels. In recent years the application of this principle to more than a single pair of driving wheels has begun to take hold until the principle of a completely flexible wheel base has now been put to the test and found to give good results in service. Applied three years ago on an order of 4-8-4 locomotives for the Union Pacific, it has now been carried out completely on an order of eight-coupled articulated locomotives for that railroad, a description of which appears elsewhere in this issue.

As applied on these locomotives, all wheels are fitted alike to the track gage, there being no variation in the distance between the backs of tires on any of the locomotive wheels. With the rear pair of driving wheels on each engine unit installed without lateral and serving as the pivot for the curving of the locomotive, all other driving wheels and the four-wheel engine truck are free to adapt themselves to the curvature of the track against fixed initial lateral resistances. With these resistances suitably selected the locomotive adapts itself to the curvature of the track with a cushioned build-up of the guiding resistances so that the steam locomotive actually follows the course of the curves instead of passing around it in a series of chords with more or less violent changes in direction from each one to the next. The smoothness of action of the locomotive thus permitted on curves exerts a beneficial influence not only on the effect of the locomotive on track but on the wear of the locomotive running gear as well.

But it is not alone in curving that this extension of controlled lateral movement to the entire wheel base of the locomotive is beneficial. The control of lateral in curving permits the absence of undesirable free lateral on tangent track. This steadies the motion of the locomotive and this also should be reflected in less wear and tear on the running gear.

Another refinement in the running gear design which has been coming into use during recent years is the application of coil springs between the ends of the fixed spring hangers and the locomotive bed and trailer-truck frame. This is of particular importance in locomotives with long wheel bases such as the articulated locomotives described in this issue and permits changes in the effective length of these hangers which otherwise would remain constant. Adjustments in load distribution are thus facilitated, particularly on vertical curves, without the extremes of unloading and overloading which otherwise would take place in passing through such curves.

Both of these features are doing much to make the long wheel-base articulated locomotive a highly flexible but completely stable machine.

Where Is The Excess Capacity?

Surveys have been made, from time to time, which indicate that the repair shops of American railroads rank with army arsenals at the bottom of the list in the matter of the antiquity of machine tools and shop equipment—based upon the percentage of the total number of machines of 10 years old and older—over 80 per cent of the tools in railroad shops being beyond the 10-year mark. It is rather difficult to understand the managerial philosophy that permits the plant of a vital industry to reach such a state of obsolescence with respect to its important machine units.

Before the present emergency arose the army had a perfectly good excuse—several of them, in fact—for the condition in the arsenals. The principal one, however, was the fact that when an emergency arose the major part of the burden for producing the material and munitions of war could be turned over to private industry. This is exactly what has been done and, while the impetus of the defense job has made it possible to get new equipment for arsenals in quantities undreamed of by ordnance officers during the past 20 years, the arsenals remain a relatively minor production factor as compared to the defense-material output of private industry. They are, in fact, the experimental laboratories of the army.

The railroads, on the other hand, would find it rather difficult to fall back on private industry for the major part of the maintenance of motive power and rolling stock, because the plants that are equipped to do that kind of work in the necessary volume to meet rail transportation needs are insufficient in number to be any real factor.

The foregoing discussion is presented as background for exploring the possibilities of doing two things that have been suggested during recent months in several quarters, namely: that of using the "excess capacity" of railroad shops for defense production work or transferring a portion of the skilled mechanics in railroad shops to other industries where they may be more urgently needed.

Without going too deeply into the statistics of the maintenance of equipment it may help considerably to put a few figures into this record in the hope that an interpretation of them may assist in an understanding of this question. Back in February, 1937, there were 7,228 steam locomotives "in or awaiting shop." In February, 1938, there were 6,672; in February 1939, 8,459; in February 1940, 6,324 and in February 1941, 5,853. This figure has been steadily dropping month by month until on August 1 of this year there were only 4,022 locomotives in or awaiting shop. Since January 1940 locomotive mileage has been increasing, due to an increasing volume of traffic until in August,

1941, for freight locomotives, the increase over January, 1940 was 10 million miles a month.

We believe it is safe to assume that the great reduction in the number of locomotives in or awaiting shop in the 19 months ending August 1 is due, in large part at least, to the fact that the backlog of idle motive power in unserviceable condition that existed 19 months ago has now gone through the shop and is either ready for service or actually in service and that the 4,022 locomotives classified as in or awaiting shop on October 1, 1941, are largely actually in the shop undergoing repair work and that we have reached a stage where the locomotives now in service and due for repairs are kept in service until they can be taken into the shop.

Man hours for machinists engaged in locomotive repair work show a steady increase from about 7,300,000 in January, 1940, to 8,618,000 in July, 1941, with proportionate increases in overtime hours.

In view of these facts, which may be interpreted with considerable latitude depending upon individual viewpoint, it is rather difficult to understand just where the excess capacity or the excess manpower may exist at the present time in the average railroad shop. We have pointed out previously that if by excess capacity it is meant that there are idle machine tools or other shop facilities it is only reasonable to assume, from general observation that, where repair facilities are idle, it is either because they are too old to be of any real productive value or because it is impossible to get skilled mechanics to operate them. Such being the case, where is the excess capacity?

There is also another side to the picture that is well illustrated by a shop containing over 300 machine-tool units over 80 per cent of which are more than 10 years old. The machines that are less than 10 years old have mostly been installed in the past five or six years, and these newer machines are carrying the principal burden of the shop. When the pressure for more output became heavier these machines were first manned by second and third trick operators and then as forces were increased many of the older machines, some of which had not been used in 10 years, were placed in service. When this stage of the expansion program had been reached the wide difference in the productive capacity and the economy between the old and the new machine tools became instantly apparent.

The only conclusions that can be drawn from this discussion is that the railroad repair shops have just about all they can do to keep up with the present demand for motive power; that the necessity of falling back on older equipment has increased the cost of doing work; that if any excess capacity exists in a railroad shop it must be in the most obsolete facilities which are idle only because they cannot be used economically and, as far as man power is concerned, the railroads are faced with a shortage of skilled mechanics and are now centering attention on training programs. The railroads are vital to the defense program and they cannot be starved of needed equipment or men without crippling that program.

New Books

A Century of Reading Company Motive Power. *Published by Publicity Department, Reading Company, Philadelphia, Pa. Bound in heavy paper. 108 pages. Price, $1.25.*

From Baldwin's first product, "Old Ironsides," built for the later-absorbed Philadelphia, Germantown & Norristown in 1832 to the latest Diesel-electric switcher, the gamut of locomotives is covered by detailed treatment of representative types. For each there appears a large-size photograph, engraving or print and text-matter, giving specifications, origin, service, disposition, and pertinent anecdotes. In addition, there is contained a brief history of the road by J. V. Hare, secretary-treasurer, and a color insert showing the entire "Crusader" train.

The Reading is remarkable for the number and importance of developments in locomotive design for which it was responsible. It imported many unusual locomotives from Great Britain; purchased the first Baldwin product (which the toolmaker said would be his last locomotive); encouraged Ross Winans' experiments with "Camels" for heavy freight service; and brought out the Milholland locomotive for burning anthracite and the Wootten firebox for burning waste anthracite. More recently it pioneered in "face-lifting" the steam-locomotive by "semi-streamlining" its fast Pacifics.

General Engineering Handbook. *Editor-in-Chief, Charles Edward O'Rourke, Professor of Structural Engineering, Cornell University. Second Edition (1940). Published by the McGraw-Hill Book Company, Inc., 330 West 42nd St., New York. Leatherette Binding. 1,080 pages and index. Price, $4.*

This book was first published in 1932 under the direction of the present editor-in-chief and a large group of contributors. Its value lies not so much in the extent of the data contained in it applicable to any one specialized field of engineering as in the fact that within its covers will be found the important fundamental data relating to the several branches of engineering. Important revisions in the second edition are the omission of some of the more highly specialized sections of the first edition and the expansion of the material in some of the basic sections of the book. The scope of the book is indicated by a list of the sections, which are: Mathematics; Mathematical Tables; Physical Tables; Engineering Materials; Theoretical Mechanics; Hydraulics; Structural Theory and Design; Plain and Reinforced Concrete; Foundations; Topographic and Geodetic Surveying; Route Surveying and Earthwork; Highways; Municipal Sanitation; Machine Elements; Pumps; Compressors, and Hydraulic Turbines; Engineering Thermodynamics; Heating and Air Conditioning; Fundamentals of Electrical Engineering, and Electrical Measurements.

THE READER'S PAGE

Reduce Brake Charging Time

To the Editor:

Since the advent of the AB freight brake equipment we have listened to many discussions as to the necessary time required to charge a train fully consisting wholly or partly of AB brakes, and as to when it can be known positively that the brake system on each car is charged to a point where a terminal test of the brakes can be made. We hear of many different time requirements for charging an AB brake, all the way from 7 min. up to 15 min., and over.

The failure to know positively that the brake system is fully charged has, on many occasions, caused the setting out of cars because the brakes would not apply. I believe I have a suggestion to offer that would benefit everybody connected with this work. It is now the universal practice to attach the air gage in the way-car to the brake pipe and this is the only indication to the trainmen as to whether there is air in the train, but it does not reflect a true picture. The rule governing terminal tests says that when the gage pressure is raised to a point 5 lb. below the feed-valve pressure on the engine, a brake application may be called for. However, we know that the gage in the caboose can indicate this pressure long before that amount of pressure is in the auxiliary reservoir of the car.

My suggestion is that this gage connection be taken from the auxiliary reservoir on the way-car instead of the brake pipe. Then the gage will always indicate to what extent the brake system is charged. An additional feature which I believe would also be a big help to the trainmen would be to use a duplex air gage instead of the current single point gage. Connecting one hand to the auxiliary reservoir and the other hand to the brake cylinder, the trainmen would then know whether the caboose brake was fully released or not, with the reasonable assurance that if there was air in the brake cylinder on the caboose some of the brakes immediately ahead of the caboose would also be applied and the trainmen could then prevent the train from departing before all brakes were released.

T. H. Birch,
Air Brake Foreman,
C. M. St. P. & P.

Keeping the Record Straight

To the Editor:

The late Sir Nigel Gresley did not contribute the three-cylinder single-expansion locomotive to railway engineering, nor was he the first to patent the principle upon which all so-called conjugate valve gears for three-cylinder locomotives are based. These facts do not reflect upon his reputation as an engineer. The man who achieves conspicuous success in any field must possess a marked talent for adapting the ideas of others to his own requirements.

Panegyrists frequently credit the subject of their eulogies with accomplishments which he may never have claimed for himself during his lifetime. Speaking before the Institution of Mechanical Engineers in Newcastle-upon-Tyne on July 7, 1925, Sir Nigel Gresley said: "The recent development of three-cylinder simple engines in England is due principally to the initiative of Sir Vincent L. Raven on the North Eastern Railway. . . . Under his direction 212 three-cylinder simple engines were built for the N. E. R. from 1909 to 1922."

It might be added that there are barely 40 recorded examples of three-cylinder single-expansion locomotives throughout the world prior to 1909. More than 100 of Sir Vincent Raven's engines were in service for some years before the first Gresley design appeared.

The Gresley valve gear for three-cylinder engines has provoked interminable argument, not only having regard to the merit of the gear as a steam-distributing mechanism, but also with respect to the circumstances surrounding its origin. It should be clearly understood that all of the existing forms of conjugate valve gear for three-cylinder locomotives are founded upon the same mathematical principle. So far as the present writer has ever been able to find, the first enunciation of this principle is contained in British patent No. 14107, which was issued to David Joy on October 25, 1884. Mr. Joy's patent contemplated the application of several forms of conjugate valve gear to three-cylinder locomotives and marine engines.

Proposals and suggestions by others followed at intervals until the subject must have become common knowledge among engineers, but no practical application appears to have been made until the winter of 1912-13. The first three-cylinder locomotive having its inner valve actuated by a combination of the movements of the two outer valves was built by Henschel and Son for the Berlin Metropolitan Railway. This was a large experimental tank engine of the 2-8-2 type, weighing 222,700 lb. in working order. The first trials of the engine were run in February, 1913, and a full description of both the engine and the trials appeared in Zeitschrift des Vereines deutscher Ingenieure for 1913, page 702. The form of valve gear used on this engine was later applied to more than 2,000 European locomotives.

According to the inventor himself, Sir Nigel Gresley conceived and designed the valve gear which bears his name in 1915, and his first three-cylinder locomotive was completed in May, 1918. By that time there were more than 500 three-cylinder simple engines with conjugate valve gears at work in Germany.

Because of the extreme difficulty in maintaining a satisfactory steam distribution with any type of conjugate valve gear, German designers and locomotive builders returned to the use of three separate gears after 1921. The Gresley valve gear has not been regarded with favor on any English railway, except the London & North Eastern. That railway now has a new chief mechanical engineer. It will be interesting to observe whether he follows in the footsteps of his predecessor, or reverts to the practice of his former chief, Sir Vincent Raven, who said in 1925: "I used three sets of valve gear and if I went back to rail work today, I would do the same again."

Wm. T. Hoecker.

Western Maryland Hopper Cars for Cement Handling

In anticipation of a greatly augmented cement movement to meet the requirements of national defense, the Western Maryland has installed modern facilities for transferring bulk cement from cars to barges at Port Covington terminal, Baltimore, Md. To take care of future needs orders were placed for 40 additional 70-ton covered hopper cars, to supplement the existing fleet.

However, during the latter part of April this year, and without any previous warning, the Lehigh Portland Cement Company announced to W. M. officers that, on May 9, (less than two weeks from the date of the announcement) they would start shipping from their plant at Union Bridge, Md., on the W. M., a huge volume of bulk cement to Baltimore for transport to barges and subsequent movement to the Newport News Shipbuilding & Dry Dock Company, at Newport News, Va. The existing fleet of covered hoppers was already handling as much cement as possible and could take care of no more. The 40 new cement cars on order would not be delivered for some months. The challenge was met with a decision to convert 30 coal hoppers for the temporary handling of this cement.

The time available was strictly limited and expense had to be taken into consideration, since after completing the haul of this particular cement tonnage, the hoppers will be returned to their regular service. The safety appliance requirements of the A. A. R. had to be met, and the principal alterations were made for the purpose of keeping the lading dry under all kinds of weather conditions.

A tarpaulin cover was decided upon as the most practical covering for the car, supported by a roof of 1½ in. by 5 in. car siding, augmented by four pressed-steel carlines. Longitudinal and latitudinal running boards were placed on top of the tarpaulin and securely fastened to the roof. As shown in the illustrations, the tarpaulins are fastened with ropes to rings welded to the sides of the car at intervals, thus keeping the tarpaulin taut and in position to protect the lading completely, while at the same time, permitting easy removal of the covering when it becomes necessary to unload the cars.

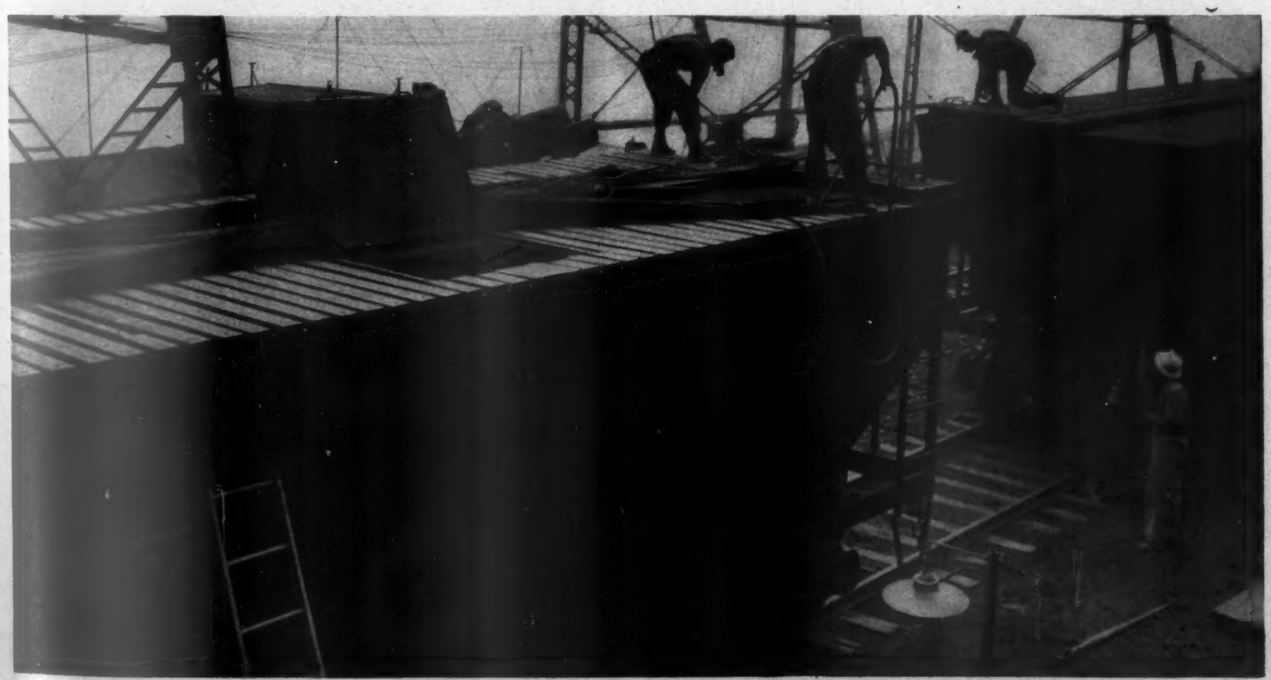
Before the converted cars were put in shuttle service between the cement plant at Union Bridge, Md., and the Port Covington pier transfer device, the insides of all the hoppers were completely sand-blasted and all scale removed, so that the cement would slide easily during unloading. The cars were also water-tested to discover any minute leaks that may have existed. The small sections that were not found watertight were closed by welding.

The W. M. shops put these cars through in record time and they were ready for the shuttle service a day or two ahead of the deadline. They have been in constant use ever since, giving excellent service. The cement company has reported no difficulty in loading or unloading and the cement has been arriving in perfect condition.

The roofs of these cars are made of 1½ in. by 5 in. car siding, spaced on 7 in. centers. These pieces are fastened to the car by ½ in. water-tight bolts through the bulb angles. In order to give additional stiffness to the roof and running boards, which must be well supported, four pressed steel carlines (on hand as scrap material), were substituted for the 12th and 24th roof boards from either end.. Wood fillers over the flat ends of these carlines assured a uniform edge, over which the tarpaulin could be drawn.

The cars are loaded through 30-in. by 48-in. hatchways. There are two of these on the transverse center line of the car, one on either side of the running board. The hatchways are covered by metal doors, made from scrap Hutchins car roof sections. The doors are hinged to open over the running board, and are 34 in. by 50 in. and close against the flange of the two inside steel carlines on two sides, and against wooden battens bolted across the under side of the roof boards on the other two sides. The roof boards themselves are cut back to clear two handles riveted to the outside edge of each door.

The tarpaulin is made of No. 6 water-proof canvas,



The converted open-top hopper cars as reconstructed to permit handling bulk cement

and turns down 12 in. on the sides and "A" end, and 8 in. on the "B" end to clear the hand brake. All corners are strongly reinforced. Ropes 3 ft. in length are used to tie down the tarpaulin to a series of special rope locks, which are welded to the car. Tie ropes are secured to the tarpaulin through grommets, spaced to suit rope locks. The tarpaulins and rope locks were furnished by the F. M. Stevenson Company, Baltimore, Md., made especially for use on these cars.

The longitudinal running board is made of 1⅛ in. by 6 in. wood and carried by 10 saddles of 3-in. by 3-in. by 19-in. wood. The latitudinal running boards are of the same dimensions and carried by three 3-in. by 3-in. by 26-in. wood saddles. Milar car cement is used under

Attaching tarpaulin ropes to the rings on a car side

the saddles as a water-proofing agent. In order to meet the I. C. C. safety requirements, side and end ladder treads were changed to suit a covered hopper car, and additional grab irons placed on the running boards for safety.

The hoppers are equipped with Wine cast-steel hopper frames, doors and locks, which afford a tight joint to begin with, but in order to be assured of this feature, a 2-in. strip of Armstrong Cork Company's Rk-304 cork and rubber gasket with adhesive base is placed around the hopper edges. This provides a tight door and seals it against possible loss of cement.

Two Passenger Car Shop Devices

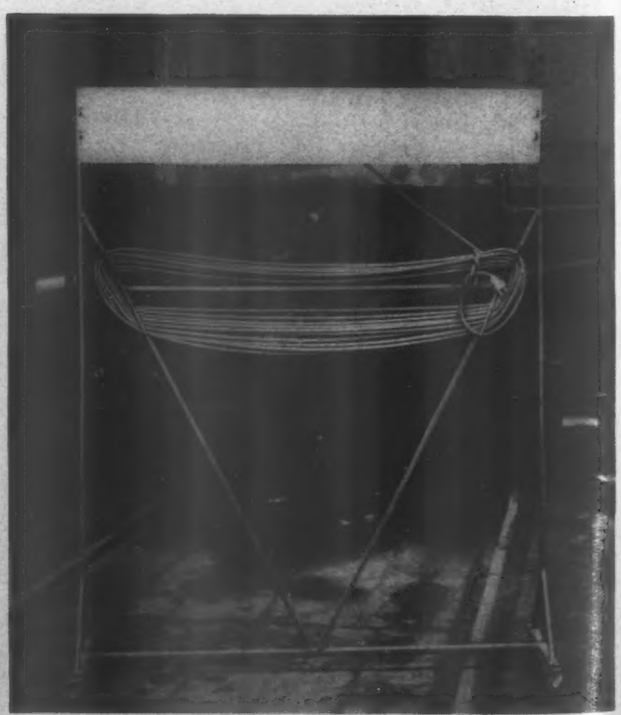
In order to save labor in handling passenger truck repairs, the Burnham coach shop of the Denver & Rio Grande Western is equipped with a 7½-ton traveling box crane at each end and at the center of the shop. The shop is slightly more than long enough to accommodate two conventional passenger cars on each track, so the trucks may be run out from each end of each car and the wheels changed, also bolsters, equalizers, or springs, and brake work done without any manual lifting or jacking of the truck frame.

The crane consists of two 12-in. channels with cross

A 7½-ton box crane with electric-operated hoist for truck repair work

members and diagonal braces welded in place. It is designed to operate on four wheels which traverse light rails extending crosswise of the coach shop tracks. The electric motor operates cables which lift both ends of the truck simultaneously under push button control. The crane is traversed crosswise of the shop by hand so it may be readily located over any track.

A portable fluorescent light stand effectively lights the inside of the cars being repaired or painted. The stand consists of a 1-in. channel iron framework, 54 in. long by 60 in. high. Casters on the bottom facilitate easy

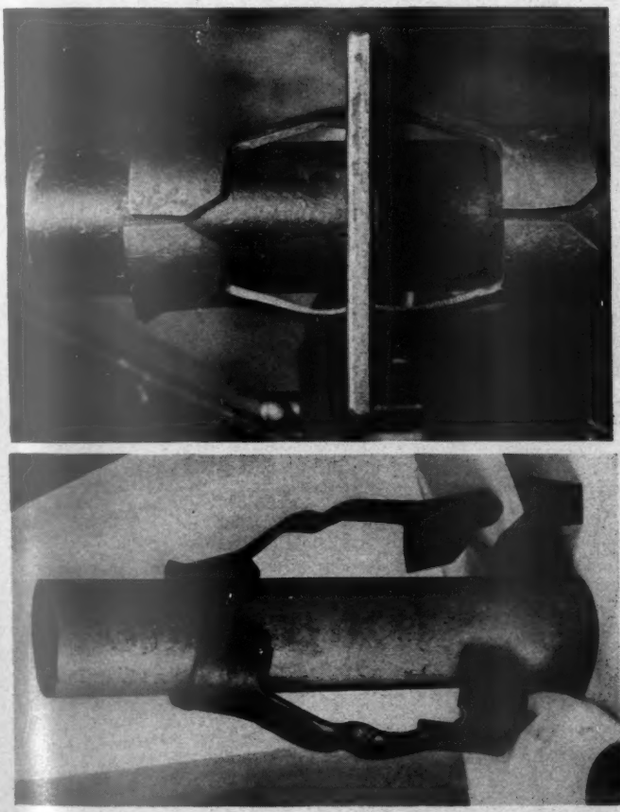


Portable fluorescent light stand for lighting coach interiors

movement about the shop. The light trough is made of welded No. 12 gage iron, 5 in. wide at the bottom and having a flaring top 8 in. wide. A transformer is built into the base of this lighting trough, the interior of which is painted with white enamel to give good reflecting properties. Either end of the trough is equipped to support two 4-kw. fluorescent light bulbs. About 100 ft. of cord are available so that the fluorescent light stand may be placed wherever desired inside the car.

Flexible Pipe Clamp

The Baker clamp, now being introduced by the Du-Wel Steel Products Company, Chicago, utilizes a new principle in air brake pipe clamping which is said to give a firm, continuous grip on the pipe and yet afford sufficient flexibility so that the pipe is permitted to assume its natural position, without initial stress on pipe joints or



Du-Wel Baker clamp designed to hold air-brake pipe firmly but without rigid connection to the car frame

fittings, and with vibration largely absorbed in the clamps instead of being transmitted to the steel frame of the car.

The new Baker clamps are made of two sections of specification spheroidized annealed spring steel, tempered to the exact degree of Rockwell hardness found desirable by extensive laboratory tests and service experience. As shown in the illustration, these clamps snap in place with a few hammer blows and can be easily driven out for re-use as many times as may be desired. With this type of clamping device, it is said that there can be no "over-clamping" and that all stress or strain on pipes having a tendency to cause leaky joints and pipe breakage are eliminated.

Air Brake Questions and Answers

AB-8, Empty and Load Equipment (Continued)

23—*Q.—How does the strut cylinder volume function?* A.—This volume with choke *103* in the pipe bracket (shown in Fig. 5) operates to control the air supply to the change-over valve. This is set up to furnish sufficient time for the change-over valve to assume its proper position at the time an uncharged air is connected to a charge brake pipe. During an emergency application it seems to prevent the change-over valve from operating.

24—*Q.—What is the purpose of the cut-off valve portion?* A.—The change-over operation at such a time as the brake pipe on the cars is being recharged is required. This would occur on picking up a car after having been set out for any reason.

25—*Q.—Of what parts does this portion exist?* A.—Referring to Fig. 6, it has a piston (*66*) with slide valve (*67*) attached, diaphragm (*72*) and spring (*76*).

26—*Q.—What is the value of the spring?* A.—30 lb.

27—*Q.—When the brake pipe pressure is reduced below 30 lb., what happens?* A.—As the spring valve is 30 lb., the piston and slide valve moves downward so that the port from the brake pipe to the strut cylinder and change-over portion is opened by the slide valve. Air is supplied to these portions for change-over operation on a subsequent recharge of brake pipe.

28—*Q.—When do the piston and slide valve assume their upper position again?* A.—When the brake pipe pressure is restored to above 30 lb., the piston and slide valve assume their upper position, where the supply to the change-over portion is cut off.

29—*Q.—Describe the parts of this portion.* A.—Large change-over piston *4* with slide valve attached (Fig. 6) and small change over piston *16* fitted to the stem of the former. Latch piston *20* (Fig. 5) lever and latch *26* and *27*, slide valve strut *10* (Fig. 6) diaphragm and spring *11* and *13*.

30—*Q.—How many positions has the large change-over piston, and when is the latch piston in operation?* A.—The large change-over piston has two positions empty (down) and load position (up). The latch piston is operated only during the change-over period, air from the brake pipe via cut-off portion forcing it upward. This caused lever *26* to withdraw latch *27* from engagement with the change-over piston, and the piston assumes its proper position.

31—*Q.—What happens after the change over is effected?* A.—The latch springs *24* and *25* return the latch to its lower position, where the latch holds the change-over piston in its proper position.

32—*Q.—What is the function of the slide valve strut?* A.—It holds the slide valve to its seat by reason of the pressure exerted on the diaphragm by brake cylinder air.

33—*Q.—What flow of air does the transfer valve portion control in load position of the change-over portion and during release?* A.—To the brake cylinder in load position, permitting the empty cylinder to apply in order to take up the brake rigging slack previous to the application of the load cylinder. In release pressure from the load cylinder ahead of pressure from the empty cylinder to prevent strain on the load cylinder mechanism.

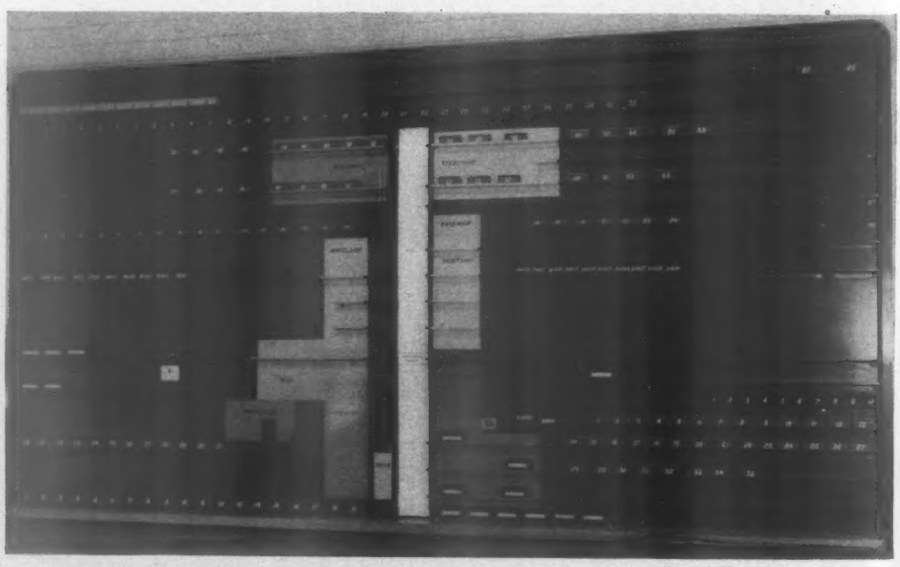
34—*Q.—Referring to Section AA, (Fig. 5), what are the operating parts?* A.—Two valves, release check *51*, and empty cylinder check *47*, with their springs and the transfer piston *41* with its spring.

Car Progress Board At Burnham Shops

One important feature of the Burnham car shops of the Denver & Rio Grande Western, Denver, Colo., is the car Progress Board, illustrated. This progress board, made of galvanized iron, about 7 ft. long by 4 ft. wide, is mounted on the office wall opposite the foreman's desk and shows at a glance not only the location of all car shop buildings, repair tracks, etc., but also indicates the location of all cars which are undergoing or awaiting repairs here.

The progress board is flanged on the outside 1 in., with welded corners and having 1-in. horizontal strips flanged and riveted in place at all track locations, both inside and outside of the shop buildings. The location of the transfer table is plainly indicated, also the various shop buildings, which are shown with different colored paints. The different series of cars repaired at Burnham shops are represented by small wood blocks which indicate either by their shape or color the type of car referred to. For example, the block representing a box car is painted red and has roughly the proportions of a box car, being a little higher for an automobile car than for a common box car. Flat-car and caboose-car blocks have the distinctive shapes indicated and are painted black. Outfit cars, on the other hand, are painted gray. It is the duty of the foreman to change the position of these car blocks after each day's work and thereby reflect the progress of the cars through the shops and the location of all cars on the outside tracks at any time, rendering it possible for the superior officer, at a glance, to observe the status of deferred or shop program.

The outer office, adjacent to that of the general car foreman at Burnham shops, is well lighted and is equipped with four desks for the use of department foremen and supervisors.



General car foreman's Progress Board for indicating car positions at the Burnham shops of the D. & R. G. W.

Four-position desk arrangement in the car supervisor's office

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Keeping Babbitt On Valve-Rod Crossheads

Q. We have encountered trouble keeping babbitt on valve rod crossheads. The metal breaks off in large pieces necessitating frequent rebabbitting. Can you suggest a method of holding this babbitt in place?

A.—There seems to be no positive way of holding babbitt in place. Some roads apply wear-resisting bronze in place of the babbitt. A heavy layer of bronze is applied to the three sides of the crosshead and machined to size. While this operation requires more time than the babbitt method, the subsequent wear is well worth the extra expense.

Welding From One Side Of A Locomotive Frame

Q.—Several times recently it has fallen to my lot to have to vee a locomotive frame so located that all cutting had to be done from one side. At times this was made more difficult by a casting on the back so that it could not be cut through. Is there an easy way of doing this difficult job?

A.—Use a piercing nozzle instead of a cutting nozzle. The piercing nozzle is swung from side to side making a cut about two inches wide about five-sixths of the way through the frame. The regular nozzle is then put back in the torch and the remainder of the frame cut and the V made to suit the operator.

The First Bead In A Vertical Vee

Q.—I have a great deal of trouble with the first bead in a vertical vee when using heavy coated rod. How can the difficulty be overcome?

A.—Experienced welders often have the same difficulty with the first bead in a vertical vee when using coated rod. Although there are those who discourage the use of a down-hill first bead, it has been accepted by many welders as the best way of overcoming the practice of filling the vee with "bunches of grapes" and the usual laps and slag inclusions. When running a down-hill bead be sure and use heat (amperage) enough to secure sufficient penetration.

Changing The Tone Of Chime Whistles

Q.—Many locomotive whistles are of the five-tone chime type and are very shrill. There has been a great deal of complaint about these whistles and we are desirous of finding a way to deepen the tone of those used on locomotives operating in the territory where the most complaints are made.

A.—In order to deepen the tone, the short steps on the whistle must be eliminated. Melt or cut the top from the two short steps. If the casting is bronze, chip or file all sand and dirt from the parts that will need welding. The next step is to shape some ⅛-in. plate into pieces that will have the same radius as the whistle and reach from the top of the short steps to the top of the casting. Two narrow strips will be needed to continue the ribs to the top. The pieces are now ready for brazing. The casting is preheated, the pieces held in place and brazed securely. A small curved section is made for the top and this brazed in place.

Cutting Through Layers of Rust

Q.—Is there any way of solving the rust problem when cutting scrap, especially on parts such as bolsters, where the operator must cut through two or more thicknesses of metal with a layer of rust between each one?

A.—Instead of attempting to cut through the numerous layers, hold the torch parallel with the work and cut one layer at a time. Through the kerf formed by this cut, clean the rust from the next layer with a hammer and chisel and proceed in the same manner. This works equally well on scrap boilers where there is a heavy scale on the inside.

High Production Turret Lathe

The Jones & Lamson 2½-in. by 40-in. turret lathe illustrated is a high-production tool recently installed in a large western railroad shop and used exclusively for machining and fitting engine frame bolts having a taper of 1/16 in. in 12 in. The hex heads of these forged bolts are gripped in the air-operated three-jaw chuck and the

Turret lathe tooled for the rapid production of locomotive frame bolts

frame bolt fitted and threaded in one set-up on the machine using five operations—(1) pointing, (2) cutting for thread size, (3) cutting for length, (4) tapering for size, and (5) threading, using a special die head.

Where only a few bolts are required, the operator takes the bolt size at the locomotive, but with a fixed size these bolts can be machined from floor to floor in 4 min. each. Saddle bolts, 1½-in. by 6-in., require only 2½ min. each. Individual bolts, when cut from 1½-in. by 18½-in. rough stock, are machined to 1¼-in. in one cut taking about 15 min. The machine is used on two shifts in order to maintain the production for this shop. Large modern locomotives, even with cast-steel bed frames, frequently require as many as 78 bolts to be fitted for each locomotive.

SETTING TIRES

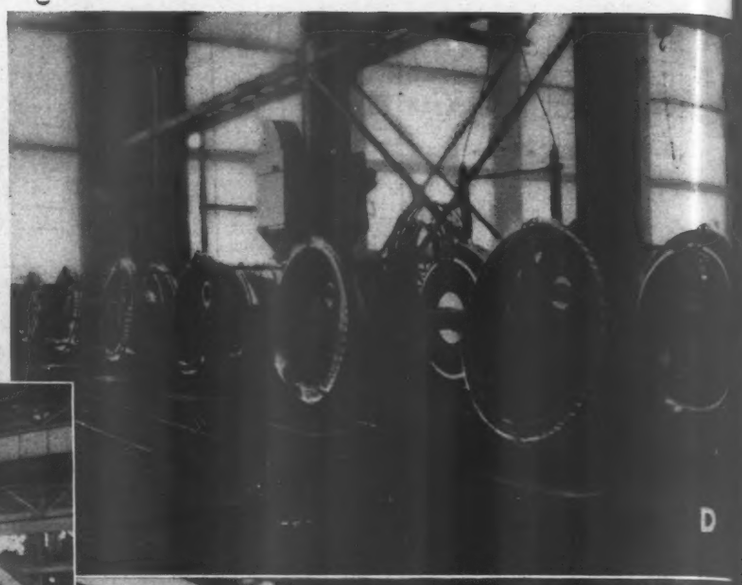


Fig. 1—(A) The tram gage is set across a pair of wheel centers and the gage is centered by means of the scales when the pointers are against the outside wheel hubs; (B) The runners on the tram gage are set with the inside micrometer shown in Fig. 4; (C) After the runners on the tram gage are properly set the spreaders are set between the wheel center rims; (D) A set of wheel centers for an articulated locomotive on the stands with the gas tire heaters in operation—the gas flame, when properly adjusted as to air proportions, is blue but in this case the amount of air was cut down to produce a flame that would show in the photograph; (E) The sliding contact point on the runner; (F) The heated tire is pushed onto the center

At the Huntington, W. Va., shops of the Chesapeake & Ohio, several advanced ideas have been developed in connection with the machining and assembly of the parts of locomotive running gear all leading to the ultimate erection of the wheels, bearing and frame assembly in absolute alignment when the locomotive leaves the shop after general repairs. An interesting phase of this work is the setting of driving tires on wheel centers and this article is concerned primarily with that job.

In the development of improved shop methods in connection with tire setting, several devices designed to facilitate the work and effect economies have been installed. Among these are a full set of mounted-wheel stands to accommodate six pairs of wheels, a full complement of gas-fired ring heaters, spreader gages, micrometers and spring clamps. These will be described in connection with their use.

The illustrations in Fig. 1 show the type and construction of the wheel stands of which there are two supporting each axle. The wheel centers on which tires are to be mounted are set on these stands.

In setting tires three sets of gages are used: an inside micrometer shown in Fig. 4 used for checking the distance between wheel hubs and for setting the runners (*6*) on the tram gage shown in Fig. 1; a gage, shown in Figs. 3 and 5, for checking the distance from the tire flange to the wheel hubs; and the spreader gages which are placed between the rims of the wheel centers—three to a wheel pair, 120 deg. apart.

The construction of the inside micrometer is clearly shown in Fig. 4. The tram gage and the manner in which it is used is shown in Fig. 5. The tram gage consists of an 84-in. bar (*2*) with scales 16 in. long one at each end of the bar. These two scales are divided in inches and sixteenths and each reads from zero at the inner end to 16 at the outer end. The inner ends, or zero points, are 53 in. apart. Since 71 in. is the maximum axle length, and 8 in. is the maximum hub thickness (*B*) the 16-in. scales are sufficient for all requirements.

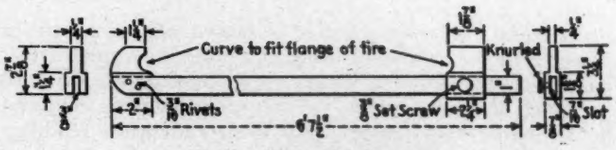


Fig. 2.—Tire and hub gage

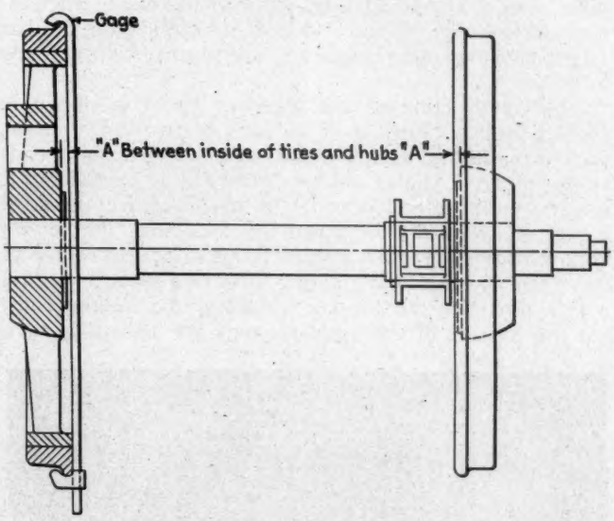


Fig. 3.—Application of the tire and hub gage

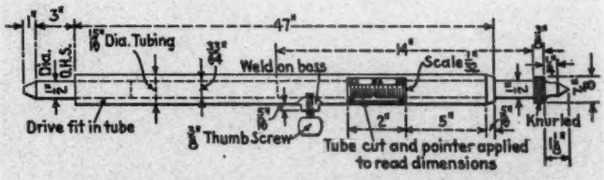


Fig. 4.—Inside micrometer for setting spreader gages

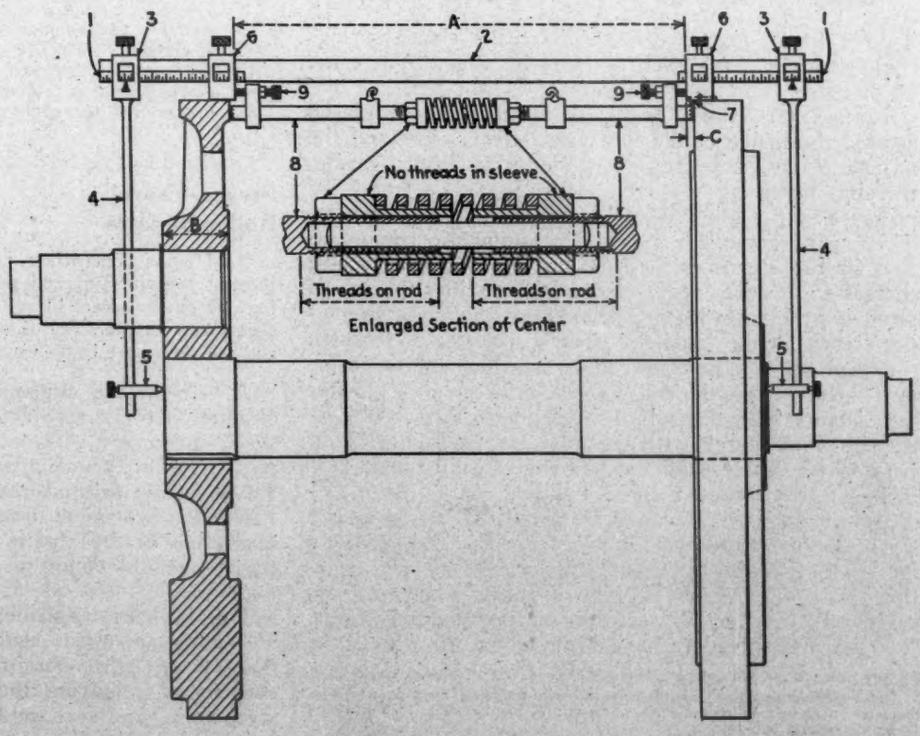


Fig. 5.—The use of the tram gage on a pair of wheel centers is shown in this drawing together with a section of the spreader gage and its application to the wheels

In using the tram gage it is placed across a pair of wheel centers, as shown in Fig 5, after the runners (*6*) have been set with the inside micrometer at the distance to which the tires are to be set. The gage is centered by adjusting the runners (*3*) so that identical readings appear on both scales (*1*) when the pointers (*5*) are against the outside of the wheel hubs. The tire setting dimension (*A*) having been set with the inside micrometer the runners (*6*) are locked in position on the bar (*2*) and the spreader gages (*8*) are put in position ready to be set.

The construction of the spreader gages is shown in Figs. 1 and 5. Each gage consists of two hollow rods, each threaded at one end and with knurled solid ends at the other. At the solid end there is a fixed bracket integral with the hollow rod. In this bracket is threaded a gaging screw (*9*) on which is a lock nut. These two hollow rods slide over a solid rod and at the center of this assembly is a heavy spring with two seats or collars which slip over the threaded ends of the hollow rods. On the threads of these hollow rods are adjusting nuts.

Fig. 6.—The spring clamps for holding the heated tires while they are cooling. The axle stands are also shown in this photograph

Two welded collars with hooks for the clamp springs complete the assembly of the spreader gage. There are 18 of these gages in a complete set.

In use, the knurled ends of a spreader are placed against the inside of the two wheel-center rims and the adjusting nuts are moved toward the center spring, thereby increasing the tension on the spring and the pressure of the knurled ends against the wheel centers. This spring arrangement provides automatic compensation in the spreader for any pulling-in of the wheel centers as the tires are cooling and simplifies the job of removing the spreaders. The distance over the two gaging screws in the brackets of each spreader is set with the tram gage. The tram gage is first set with an inside micrometer to the desired distance between tires. After the distance from the hub to the inside of the wheel center rim is measured with the gage shown in Fig. 2 on both wheel centers and the amount of adjustment (*C*) in Fig. 5 determined, there is a sliding contact point (*7*) on one runner (*6*) of the tram gage that rests against the inside of the machined wheel-center rim and definitely locates the gage and ultimately the tire setting with relation to the wheel centers. This distance, when set, represents the distance between tires on the mounted wheels.

When the spreaders have been set on all wheels the tires are placed on the wheel centers and the gas heaters set up and lighted. A blue chalk mark on each tire is used as an indicator for proper setting heat, this mark changing to yellow at about 350 deg. F. and to white at about 400 deg. F. At this temperature, a tire for a 50-in. center which has been bored .059 in.* smaller than the outside diameter of the wheel center will have expanded to approximately .125 in. larger than the wheel center so that it is quite free to slip over the center.

Measurements Between Tires on Two Driving Wheel Sets

Point at which gaged	Wheel Set No. 1		Wheel Set No. 2	
	Hot, in.	Cold, in.	Hot, in.	Cold, in.
Top	53.345	53.326	53.260	53.245
90 deg.	53.330	53.305	53.265	53.254
Bottom	53.350	53.325	53.270	53.260
270 deg.	53.345	53.325	53.275	53.260
Nominal setting	53.375		53.250	

The hot tires are now pushed onto the centers and up against the gaging screws of the three spreaders. Spring clamps are then hooked over the tires, as shown in Fig. 6, to hold the tires in position while cooling.

This method of setting tires has eliminated the necessity of returning mounted wheels from the wheel lathe to have the tires reset when they are found to have excessive "run-out" and cannot be machined without resetting.

The table shows the degree of accuracy to which tires may be set by this method.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Steam-Shovel Boiler Repairs

Q.—I am a boilermaker employed by a mining company and thought perhaps you could give me some suggestions on repairing one of our steam-shovel boilers. The inner and outer door sheets are flanged towards each other and riveted. The rivets and the sheets are badly worn and must be repaired.—C. J.

A.—From the explanation given in the question, I assume that the repair to be made is to the fire-door hole. Repairs to fire-door holes can be made by welding. The inner and outer door sheets are supported by staybolts and for this reason the strength of the structure is not dependent upon the strength of the weld. The magnitude of the repairs to be made would depend entirely upon the condition of the sheets forming the fire-door hole.

Fig. 1 illustrates a method of repair when the rivets and seam are worn and leaking, the inner and outer door sheets otherwise in good condition. This repair consists of removing the rivets and plug welding the rivet holes, and seal welding the seam.

* This difference for other diameter wheel centers is as follows: 44-in. diameter, .050 in.; 56-in. diameter, .069 in.; 62-in. diameter, .079 in.; and 66-in. diameter, .086 in.

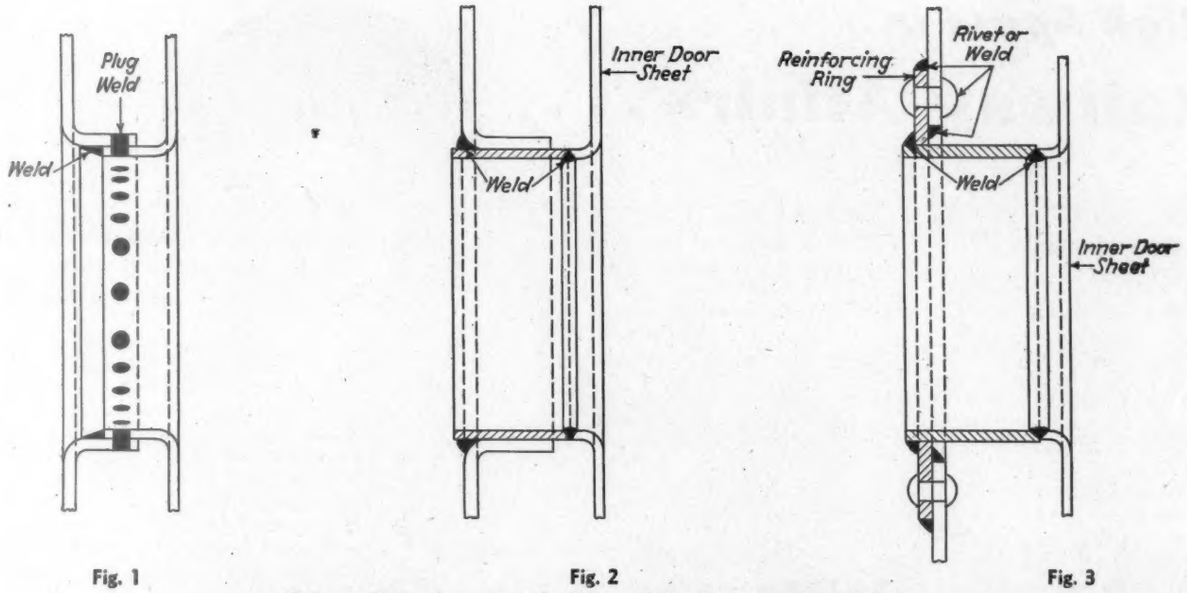


Fig. 1 Fig. 2 Fig. 3

Three methods of repairing the firedoor hole of a steam-shovel boiler

Fig. 2 illustrates a method of repair where the sheets forming the fire-door hole are badly worn in the hole and the seam itself is in a bad condition. This repair consists of removing the rivets and cutting out the inner door sheet of the fire-door hole at the knuckle; a new fire-door hole sheet is formed to the contour of the correct contour and butt welded on the top center line; the new ring is then inserted and butt welded to the inner door sheet and secured to the outer door sheet by a fillet weld.

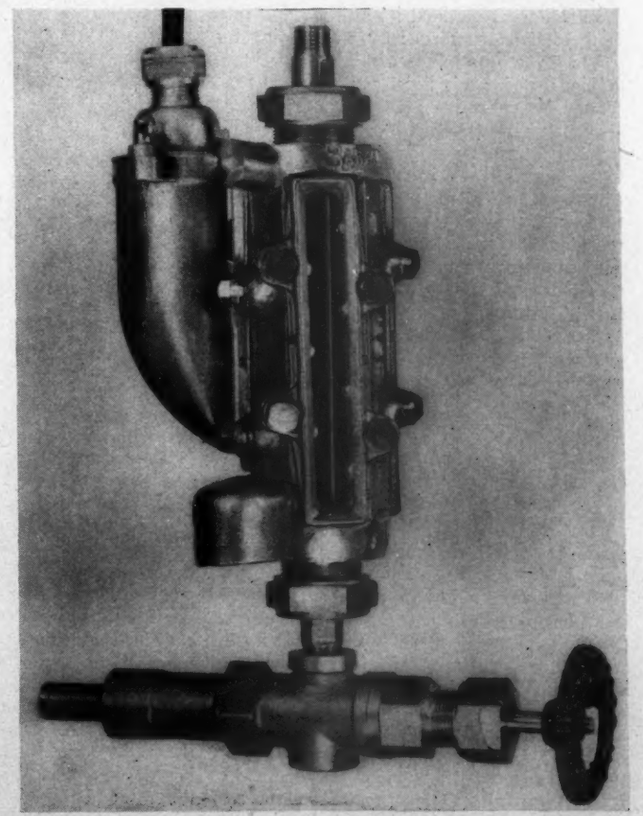
Fig. 3 illustrates a method of repair where the sheets in the fire door hole and the knuckle of the outer door sheet need renewing. This repair consists of cutting out the outer and inner door sheets, and applying a new fire-door-hole sheet, as in Fig. 2; in addition, a ring is riveted or welded on the outside of the outer door sheet to support the fire-door-hole ring. The fire-door-hole sheet is welded to the ring on the outer sheet as shown in Fig. 3.

All welds and repairs should be made to conform to the requirements of the A. S. M. E. code and before proceeding with the repairs approval should be obtained from the State Inspector under whose jurisdiction the boiler comes.

Protector for Tubular Water Glass

An improved locomotive tubular waterglass protector manufactured by the Sargent Company, Chicago, includes features giving added protection against personal injuries and simplifying the renewal, cleaning and replacement of the glass panels in the body without removing the protector or disturbing its steam connections. The tubular glass is inserted in the protector before the unit is attached to the water-glass cocks. It has an ample escape passage at the base, threaded for a pipe connection, to divert escaping steam, water and tubular glass fragments below the cab deck in the event of a bursted tubular glass under pressure. However, if this passage becomes clogged from any cause, the entire structure will withstand pressure and prevent the release of any damaging elements within the cab.

A ball check at the top, normally open, permits air circulation within the protector to prevent misty glass panels, but closes automatically at the slightest accumulation of internal pressure. A small brass tube integral with the fittings enters each end of the tubular glass to prevent the gasket from fouling the glass ends and producing a false water-level reading. The detachable bayonet-type lamp with insulated electric connections and socket illuminates the water level at all times but no light rays escape to interfere with the crew's vision.



The glass panels in the Sargent tubular water-glass protector can be cleaned and replaced without disturbing the steam connections

High Spots in
Railway Affairs . . .

Holiday Travel Of Soldiers

It looks as if there would be a record-breaking amount of passenger travel during the holiday season. There are now about 1,600,000 men in camps, as compared with about 500,000 a year ago. A new War Department regulation provides that following the maneuvers or similar specialized training periods, and during the Christmas holidays, up to 50 per cent of the individuals in an organization may be given furloughs at one time. Previous regulations restricted this to 15 per cent. Ralph Budd, defense transportation commissioner, has indicated that during the Christmas holidays service men on furlough will get the first call on transportation facilities.

Transportation Study Board

The Board of Investigation and Research, which was created by the Transportation Act of 1940, has apparently finally got started on its task. It is scheduled to make its final report by September, 1942. C. E. Childe, a member of the board, in a recent address outlined its attitude and job in the following words: "We are going to try to divest our minds of all preconceived opinions and prejudices, and, first, be a sponge for collecting all the available facts about transportation from every possible source; second, put these together in a form that will be informative to anyone who wants to study them; third, possibly we can then reach conclusions and make recommendations which will be valuable." The carriers are being called upon for a vast amount of information. They not only want this, but also in the words of Mr. Childe, "we want your advice and your best judgment on the broad question of how to develop a national transportation system which will best serve our national welfare."

Ice Cream for Soldiers

One example of unusual services required of the railroads by the troops on their maneuvers is the ice cream movement between Baltimore, Md., and Hamlet, N. C., a distance of 404 miles. To begin with, there was no tariff in existence to cover such a movement and it was necessary to quote special rates and receive the approval of the Interstate Commerce Commission. On September 28 the first of these movements included a train of 38 refrigerator cars. This is believed to be the first railroad shipment of ice cream in carload lots and probably the longest haul of this product in any quantity. In addition to the ice and salt in the bunkers, dry ice is packed between the cartons. At Hamlet, N. C., the ice cream is transferred to trucks and carried to destination in the field. Two or three deliveries are made at Hamlet each week and it is expected that this movement of ice cream will keep up until the maneuvers are completed. The shipments are routed over the B. & O., R. F. & P. and the Seaboard Air Line.

Guard Against Fire Losses

Few improvements in railroad operation over the years have been more spectacular than the reduction in losses by fire. In 1940 these totaled $3,557,764, or only about one-third of what they were in the year 1920, when they reached the peak. The 1940 record also shows a reduction of 16.3 per cent as compared to 1939. The average loss per mile of line in 1940 was $12.96, in 1939 $16.32 and in 1920 $54.40. These improvements are due largely to the persistent activity of the Fire Protection and Insurance Section of the A. A. R., and its predecessor organization, the Railway Fire Protection Association. A determined effort has been made by the railroads to locate the cause of every fire and then, with these facts established, to remove or reduce similar hazards wherever possible. Of the known causes of fires in 1940, those caused by trespassers on railroad property ranked first, and those caused by careless smokers who tossed away lighted matches, cigarettes and cigars ranked second.

Wage Negotiations

The hearings before the Emergency Board followed fairly closely the schedule set up in advance. Some unexpected developments, however, did occur. The carriers at one stage in the game submitted a plan for emergency compensation, which took into account the cost of living and revenues and would be in effect from November 1, 1941, to December 31, 1942. The labor leaders turned their thumbs down on this proposal. On October 18 the chairman of the Emergency Board suggested that the parties agree to arbitrate. The railways were willing to do this, but the labor leaders declined this proposal also. On October 21, board member Joseph H. Willets found it necessary to withdraw for several days, because of the death of his son. The hearing concluded on October 22 and the board started its deliberations. The board, with the concurrence of labor and the carriers, secured from the President a five-day extension of time for the preparation of the report. It will be presented to the President on November 5.

Spreading Information About Defense Contracts

How can a small manufacturer secure national defense contracts or know whether his plant is capable of doing such work for the government? In spite of all of the efforts that have been made to get such facts over to the smaller manufacturing concerns, it seems that something more intimate must be done by way of carrying this information in a more or less dramatic way to the four corners of the country. On November 10 three special trains, painted red, white and blue, will start from Washington. Each train of six cars will be equipped with samples of work to be done and other exhibits and conference tables. Two cars of each train will be used as living quarters for representatives of the Army, Navy, Maritime Commission and the Office of Production Management. These trains will not be open to the public, but manufacturers who are interested will have an opportunity of sitting down with the experts, first to find whether their equipment is such as to be capable of producing the necessary products, and then in advising those who have the right sort of equipment how to proceed in securing contracts. Interested manufacturers should contact with the nearest field office of the O. P. M. Contract Distribution Division.

Scrap Situation Serious

Our nation has been quite prodigal in shipping scrap abroad in recent years. With the great speeding up of production for war and national defense purposes, we now find ourselves in a rather serious predicament because of the shortage of scrap. The Office for Emergency Management has requested the railroads to check their entire systems in order to make available quickly all possible scrap. It emphasizes the following specific suggestions: "(1) Remove railroad sidings, branch lines and industrial tracks where they are not actually needed for present or prospective business. Appropriate action by public bodies is requested to facilitate this program. (2) Check equipment and dismantle promptly cars and locomotives that are not to be repaired. (3) Check miscellaneous facilities such as junk tools, bridges and buildings and dismantle those no longer needed to the extent necessary to make available all metal for scrap." Ralph Budd, defense transportation commissioner, announced that steps were being taken to reclaim street car and railroad rails which have been abandoned and have been left imbedded in the city streets. He estimated that there are 232,000 tons of such material.

(Turn to next left-hand page)

KEEP 'EM ROLLING FOR DEFENSE

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4 SAVINGS WITH CHILLED CAR WHEELS:

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3. **Increased brake shoe life.**
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Among the Clubs and Associations

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—Meeting: November 20, 10 a. m., Ansley Hotel, Atlanta, Ga. Speaker: A. F. Stuebing, development engineer, Carnegie-Illinois Steel Corporation. Subject: Lightweight equipment. Stereopticon illustrations.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Meeting: 8 p. m., November 10, Hotel La Salle, Chicago. Speaker: D. J. Jones, service engineer, Vapor Car Heating Company. Subject: Temperature Control of Passenger-Car Heating.

NEW ENGLAND RAILROAD CLUB.—Meeting: November 12 (instead of November 11, Armistice Day), 6:30 p. m. (dinner), Hotel Touraine, Boston, Mass. Speaker: Kenneth Cartwright, mechanical engineer, N. Y. N. H. & H. Subject: Progress in Steam Locomotive Design.

CANADIAN RAILWAY CLUB.—Meeting November 10, 8:15 p. m., Windsor Hotel, Montreal.—Speaker: J. A. M. Galilee, Westinghouse Air Brake Company. Subject: New tools for Research. Illustrated.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

ALLIED RAILWAY SUPPLY ASSOCIATION.—J. F. Gettrust, P. O. Box 5522, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York. Annual meeting Hotel Astor, New York, December 1-5.

RAILROAD DIVISION.—C. L. Combes, *Railway Mechanical Engineer*, 30 Church street, New York City. Railroad Division sessions at annual meeting of society, Hotel Astor, New York, December 4.

MACHINE SHOP PRACTICE DIVISION.—Warner Seely, Warner & Swasey Co., 5701 Carnegie avenue, Cleveland, Ohio.

MATERIALS HANDLING DIVISION.—F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.

OIL AND GAS POWER DIVISION.—L. N. Rawley, Jr., Power, 330 West Forty-second street, New York.

FUELS DIVISION.—D. C. Weeks, Consolidated Edison Co., 4 Irving Place, New York.

ANTHRACITE VALLEY CAR FOREMEN'S ASSN.—Frank Kramer, 412 Hill street, Duryea, Pa. Meets third Monday of each month at Wilkes-Barre, Pa.

ASSOCIATION OF AMERICAN RAILROADS.—Charles H. Buford, vice-president Operations and Maintenance Department, Transportation Building, Washington, D. C.

OPERATING SECTION.—J. C. Caviston, 30 Vesey street, New York.

MECHANICAL DIVISION.—A. C. Browning, 59 East Van Buren street, Chicago.

PURCHASES AND STORES DIVISION.—W. J. Farrell, 30 Vesey street, New York.

MOTOR TRANSPORT DIVISION.—George M. Campbell, Transportation Building, Washington, D. C.

CANADIAN RAILWAY CLUB.—C. R. Crook, 4415 Marcil avenue, N. D. G., Montreal, Que. Regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS.—J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—Frank Kartheiser, chief clerk, Mechanical Dept., C. B. & Q., Chicago.

* * *

Photo Courtesy New Haven

President H. S. Palmer and Vice-President R. L. Pearson of the New York, New Haven & Hartford examining the first of 1,000 box cars recently delivered by Pressed Steel

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 8238 S. Campbell avenue, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1840-2, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMAN'S ASSOCIATION.—W. P. Dizard, 30 Church street, New York. Regular meetings, second Friday of January, February (annual dinner), March, April, May, October, and November at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, in Indianapolis Union Station, Indianapolis, at 7 p. m.

LOCOMOTIVE MAINTENANCE OFFICERS' ASSOCIATION.—J. E. Goodwin, vice-president, secretary-treasurer, c/o Missouri Pacific, North Little Rock, Ark.

MASTER BOILER MAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MID-WEST AIR BRAKE CLUB.—C. F. Davidson, secretary-treasurer, general inspector car department, St. L.-S. F., Springfield, Mo.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, except June, July, August and September.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

NORTHWEST LOCOMOTIVE ASSOCIATION.—G. T. Gardell, 820 Northern Pacific Building, St. Paul, Minn. Meetings third Monday of each month, except June, July and August.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Monthly meetings alternately in northern and southern California.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1647 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, Room 811, Utilities Building, 327 South La Salle street, Chicago.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July, and August, at Royal York Hotel, Toronto.

WESTERN RAILWAY CLUB.—E. E. Thulin, executive secretary, Room 822, 310 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August, September, and January.

(*Turn to next left-hand page*)

PRECISION GROUND TO A MIRROR FINISH!

On modern grinders Lima brings to a perfect finish the axles and shafts whose proper fit plays an important part in the building of a low-maintenance locomotive. The same precision and care that goes into the finish of the axle illustrated above is used in the making of each part of a "Lima-built" locomotive. It is through such attention to the minor as well as the major details that Lima has earned for itself the enviable reputation of a builder of high-quality, low-maintenance locomotives.

LIMA LOCOMOTIVE WORKS — **INCORPORATED, LIMA, OHIO**

NEWS

$25,000,000 for Rail Equipment and Facilities in Lend-Lease Bill

THE new lend-lease bill reported from the House committee on appropriations during the week ended October 11 includes an item of $25,000,000 for railway equipment and facilities. The publication of testimony on the bill showed that Clifton E. Mack, director of the Treasury's Procurement Division had stated that the item was for the purchase of track materials, locomotives, freight cars, shop machinery and equipment, and light railway material and rolling stock.

Asked what was to be done with the foregoing, Mr. Mack stated that it was for the Middle East "theatres of war"—for the extension and maintenance of railroad facilities "in order to make them capable of handling the increased traffic involved in maintaining a modern army in the field." In response to other questions, Mr. Mack said some of the equipment was now being bought, but he didn't think any of it had actually left the country.

Additional Annual Steel Capacity of 10,000,000 Tons

A FURTHER 10,000,000-ton expansion of the nation's annual steel-making capacity has been approved by the Supply Priorities and Allocations Board, and the Office of Production Management has moved to put the decision into effect. SPAB's action came in the form of an approval of a report recommending the 10,000,000-ton increase which had been prepared by W. A. Hauck, OPM steel consultant.

The OPM statement said that the expansion will be started immediately to meet, among others, such shortages as those of plates for ships, railroad equipment, armor plate for tanks, gun mounts, etc. It is estimated that some of the additional 10,000,000-tons capacity can be completed within nine months, and "substantially all of it within two years provided highest priority ratings are assigned to all undertakings." Unless such ratings are assigned, Mr. Hauck said, no further expansion should be started.

In addition to the 10,000,000-ton increase, Mr. Hauck recommended that another 5,000,000-ton expansion should be undertaken "to the extent that may be found practicable." The latter, however, would not be in the immediate program. Meanwhile the 10,000,000-ton expansion will require construction of more lake ore boats, in addition to the 25 already recommended by OPM to the Maritime Commission.

Dealing with steel-plate capacity, the report cites figures showing that the present rate of demand is 8,500,000 to 9,000,000 tons a year, while present production is at the rate of 6,300,000. Thus the deficiency is "substantially more than 2,000,000 tons." However, additional yearly plate capacity underway or approved will total 2,336,920 tons. In that connection the report says that the program being developed will provide "the balance of ingot capacity needed on the above and also the ingot and plate capacity further needed."

The OPM statement pointed out that the steel required to build the new 10,000,000-ton capacity "must be obtained by a corresponding reduction in steel available for civilian uses while the construction is under way." In other words 1.3 per cent of the present capacity must be thus set aside during each of the next two years; but "this will be returned many times over during subsequent years."

Baldwin School Shop Turns Out 1000th Skilled Worker

THE Baldwin Locomotive Works recently graduated the 1,000th student from its school-shop at Eddystone, Pa., which was opened on October 18, 1940, in anticipation of the present emergency and shortage of skilled workers. By November of 1940 the Baldwin school was operating 24 hours daily under the direction of A. L. Logan, formerly superintendent of the Williamson Trade School. In 11 months it has turned out 1,000 capable machine-tool operators.

Edward W. Thompson (left) the 1000th man to graduate from the training school-shop, organized to produce skilled workers for the production of armaments and conducted by The Baldwin Locomotive Works—Ormus M. Mills, to the right of Charles E. Brinley, president of the company, was the first graduate of the school-shop.

Early this year arrangements were made for "pre-employment" instruction in the schools of Philadelphia and Delaware counties through state employment offices under federal sponsorship. After the proper period of instruction, the students finish their training with an intensive course of instruction at the Baldwin school-shop, and are immediately put to work in the Baldwin plant as helpers and eventually as full-fledged operators of various machines. This so-called "vestibule" training has cut the time spent by learners in the school shop in half. Students in the Baldwin school are not taught to be all-around machinists, but are given specialized training in the operation of one type of machine. This makes for speed, and a more highly developed degree of skill. One man is taught the operation of a milling machine, another a drill press, others are trained to efficiently operate slotters, planers, grinders, automatic screw machines, etc.

The Standard Steel Works division of Baldwin received, on September 16, a Navy "E" pennant and Bureau of Ordnance flag, which were presented to Charles E. Brinley, president of the Baldwin Locomotive Works, by Rear Admiral P. E. Pettengill, commandant of the Navy Yard and superintendent of the Naval Gun Factory, Washington, D. C. Formerly an honor bestowed only on Navy personnel, the pennant was presented to Standard Steel for excellence and efficiency in supplying material for national defense. Three thousand employees, officers and their families were at the presentation.

Alco-G. E. Railroad Movie

A 30-min. sound motion picture in color entitled "Railroadin'" is being made available by the American Locomotive Company and the General Electric Company for showing by the railroads. The film, produced by a Hollywood company, was witnessed for the first time by a group of newspaper men and railroad public relations officers in New York on October 3.

"Railroadin'" was made by the American Locomotive Company and General Electric in co-operation with the railroads, for use by the latter for educational purposes in schools, colleges and clubs. The film (which is in 16 mm. sound only) is available to railroads at no cost other than charges incidental to shipping and may be obtained at the headquarters of American Locomotive Company, 30 Church street, New York, or the Visual Instruction Section, General Electric Company, Schenectady, N. Y. In addition the film will be available in the district offices and plants of Alco at Atlanta, Ga., Chicago, Richmond, Va., St. Louis, Mo., San Francisco, Calif., and Washington, D. C. and district

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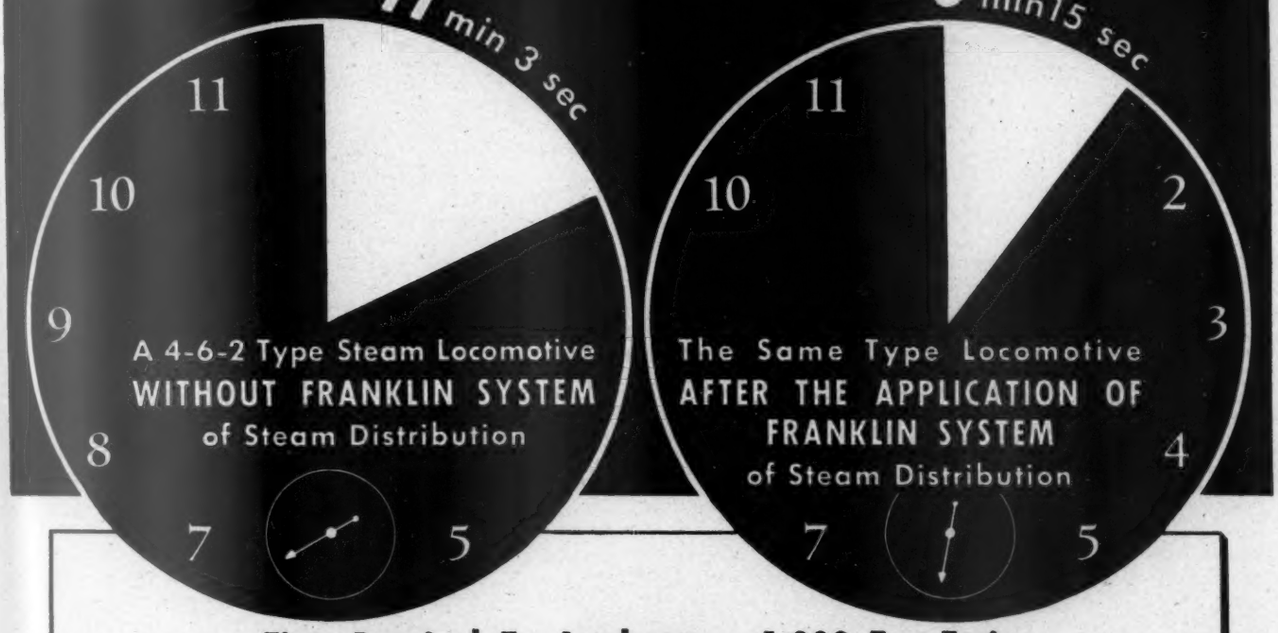
BACK TO ROAD SPEED IN HALF THE TIME



Time Required To Accelerate a 1,000 Ton Train From 40 mph To 75 mph on Tangent Level Track

The time required to get back to road speed after slow downs is dependent upon the power available for acceleration. The increased horsepower resulting from the Franklin System of Steam Distribution gives a higher margin of power to accelerate rapidly. It does this by releasing the latent power that has heretofore been unavailable due to the limitations of the piston valve. This greater power at higher speeds keeps trains on schedule.

FRANKLIN RAILWAY SUPPLY COMPANY, INC. NEW YORK CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

offices of G. E. at Atlanta, Ga., Boston, Mass., Chicago, New York, Cleveland, Ohio, Dallas, Tex., Denver, Colo., Los Angeles, Calif., Philadelphia, Pa., Portland, Ore., and Salt Lake City, Utah. For a moderate service charge the film may also be obtained from the Department of Visual Instruction, University of California, Berkeley.

The film cast includes a number of well-known Hollywood actors and a big cast of extras—but the main actors are the American railroads themselves. The film shows America in pre-railroad days; the early struggles of the roads for recognition, and a present-day railroad operation.

New Metal Substitute Developed by U. S. Rubber

DEVELOPMENT of a new non-metallic material one-third lighter than aluminum and designed to replace strategic metals in many important applications was announced on October 3 by the United States Rubber Company. The new substance, which is made from fibrous and rubber-like ingredients, has already been tested and approved by the United States Army, according to the announcement. Of prime importance in the present emergency is the fact that except for small amounts of rubber the new formula is made of non-strategic materials, and will not be affected by priorities.

The new material, which is known simply as Formula C-102, has a number of important qualities. Under gunfire, for example, it resists ripping or shattering. It will not crystallize from vibration as do metallic substances and is free from corrosion and pin-hole formation. Discovery of the new substance was made while members of the research department were working on bullet-puncture-sealing fuel tanks for airplanes developed by the company, in the search for a container for the tanks which would have all the advantages of aluminum, including lightness, yet have greater resistance to shattering and flowering when struck by bullets. The company believes that, in addition to this and many other contemplated defense uses, the new material will find many applications in normal industry.

Copper Priorities Order

THE Division of Priorities, Office of Production Management, has imposed additional rigid controls on copper and brass, issuing Conservation Order M-9-c which virtually forbids the use of copper for many civilian products. The OPM announcement, made October 21, calls the order "the most far-reaching action of its kind yet taken."

The order sets up these controls over both domestic and imported metal and scrap: (1) Use of copper in more than a hundred civilian articles is restricted to approximately 60 per cent of a 1940 base period until January 1, 1942; (2) use of copper in the manufacture of the articles listed is prohibited after January 1, 1942, except for non-decorative plating; (3) use of copper in building construction is prohibited after November 1, 1941; (4) use of copper in all items not listed is reduced to 70 per cent of a 1940 base period.

The prohibited list includes seven general categories: Building supplies and hardware; house furnishings and equipment; dress accessories; jewelry, gifts and novelties; burial equipment; automotive, trailer and tractor equipment, and a miscellaneous list which runs from fire-fighting apparatus to toys. Seven exceptions are made. Restrictions do not apply to Army, Navy, lend-lease or other government defense agency contracts where the use of copper is specified; to products covered by underwriter or other safety regulations in effect on October 1, 1941; to copper used as a conductor of electricity; in chemical plants where corrosive action makes other materials impractical; in research laboratories; for condenser or heating exchanger tubes and tube sheets in steam generating plants and oil refineries where corrosive action invalidates the use of other materials, and in hydro-electric plants.

Reasons for the order, the announcement said, "are readily apparent in supply and demand figures for October, 1941." Army, Navy, lend-lease and other primary defense agency demands for the month total 144,430 short tons. Total demand, including civilian, is 259,479 tons. Total production for the month, domestic, foreign and scrap, is 138,700 tons. And "estimates for 1942 show a continuing serious situation."

Present Status of Freight-Car Building Program

IN an article in the Railway Age of October 11 the events leading up to the present status of the railway freight-car building program to meet the needs of the national emergency are reviewed and the actual status of the program measured against the planned estimated production. The essential facts of the situation are presented in the following table which was taken from that article.

A.C.F. Increases Tank Production

THE American Car and Foundry Co. delivered its 2,000th combat tank to the United States Army on October 21, less than three months after completing delivery of its first 1,000 tanks on August 2. In this short period the company has thus equalled its production for the preceding twelve months—a four-fold speed-up.

The company also reports receipt of an order from the United States Government for an additional 1200 12½-ton light combat tanks at cost of about $31,000,000, part of which order includes spare parts and repair parts. About 900 of these tanks will use gasoline engines and 300 will be Diesel-equipped.

The American Car and Foundry Co. has also supplied large quantities of tank suspensions and tank parts to the British.

Carl R. Gray, Jr., Explains Military Railway Service

IN a recent address before the Telegraph and Telephone section of the Association of American Railroads at Cincinnati, Ohio, Col. Carl R. Gray, Jr., executive vice-president of the Chicago, St. Paul, Minneapolis & Omaha, and manager, Military Railway Service, explained the present organization of the Military Railway Service, which is assigned the operation of railway systems in combat zones forward of the area allowed for commercial operations. He said, in part, as follows:

"The operation and maintenance of standard military railways is a function of special Engineer Railway troops. Original railway construction and the reconstruction of an existing line is the function of general Engineer troops. The Chief Engineer, Theater of Operation, exercises supervision over all military railways in the

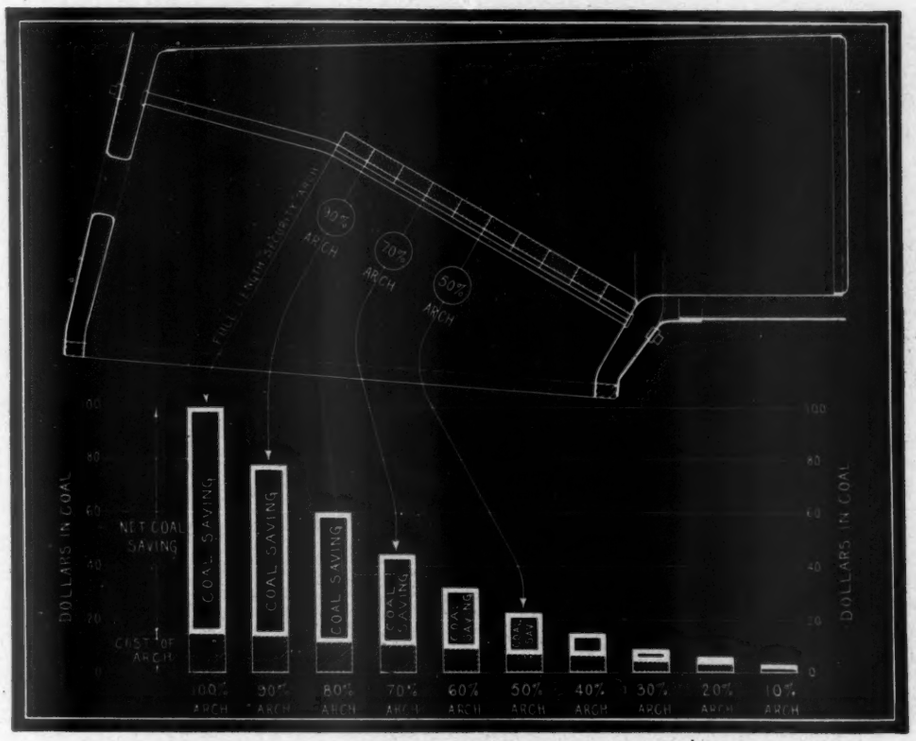
(*Continued on next left-hand page*)

Domestic Freight Car Deliveries Compared with Orders and Planned Production

Data Covers Car Builders Only
January, 1940 to September, 1941

	Orders Placed	Deliveries: Number	Deliveries: Per cent of Rated Operating Capacity (A)	Planned Estimated Production (B)	Loss in Production (Planned Production Less Deliveries)	Backlog of Unfilled Orders
1940						
January	197	5,084	35.6	....	....	20,229
February	166	5,142	36.0	....	....	15,253
March	1,404	6,548	45.8	....	....	10,109
April	792	5,400	37.8	....	....	5,501
May	2,212	3,061	21.4	....	....	4,752
June	4,329	1,478	10.3	....	....	8,603
July	5,766	1,543	10.8	....	....	12,826
August	4,024	2,356	16.5	....	....	14,500
September	8,543	2,844	19.9	....	....	20,746
October	8,674	3,586	25.1	....	....	25,947
November	7,012	3,981	27.8	....	....	30,362
December	5,476	4,293	30.0	....	....	34,205
Total, 1940	48,595	45,316	26.4			
1941						
January	6,299	4,993	34.9	....	....	34,384
February	2,728	4,057	28.4	....	....	32,991
March	9,440	4,987	34.9	....	....	37,359
April	12,478	5,300	37.1	....	....	44,707
May	19,513	4,670	32.7	6,500	1,830	59,104
June	15,341	5,130	35.2	7,500	2,370	69,355
July	6,449	5,467	38.2	10,000	4,533	70,330
August	3,145	3,856	27.0	12,000	8,144	69,307
September	600	5,044	35.3	14,000	8,956	65,230
Total, nine m s. 1941	75,993	43,504	33.8			

(A) Based upon rated operating capacity for all builders of 14,300 cars.
(B) Based on carbuilders' plans for increased production effective May, 1941.
Planned production called for deliveries during the remainder of 1941 as follows: October, 15,000; November, 16,000; December, 17,000.



THE EFFECT OF ABBREVIATED ARCHES ON FUEL SAVING

LET THE ARCH HELP YOU SAVE

With the emphasis being placed on saving every railroad dollar, the locomotive Arch becomes increasingly important.

Regardless of the amount of traffic handled, the locomotive Arch saves enough fuel to pay for itself ten times over.

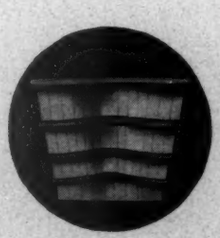
Be sure that every locomotive leaving the roundhouse has its Arch complete with not a single brick nor a single course missing.

In this way, you will get more work for each dollar of fuel expense. Skimping on Arch Brick results in a net loss to the railroad.

THERE'S MORE TO SECURITY ARCHES THAN JUST BRICK

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

theater of operations. The Engineer, Communications Zone, is responsible for the construction and reconstruction of all railways in the communications zone and for the operation and maintenance of all military railways in the entire theater of operations. This operation and maintenance of military railways falls to the Military Railway Service.

"Fundamentally, there is not much difference between the organization and functions of the Military Railway Service and the organization and manner of functioning of the Operating department of a standard steam railroad. Basically, the Manager, Military Railway Service, who has a wartime rank of Brigadier General, corresponds to the operating vice-president of any of our large American railroads. His headquarters are divided into a small headquarters detachment; and Operations department, looking after transportation and the movement of trains; an Equipment department, charged with the responsibility for the maintenance of locomotives and cars; a Track and Structures department, charged with the responsibility for the maintenance of the roadbed, bridges, signals and buildings; and a Stores department. Even the designated titles of the commissioned personnel are equivalent to the railroad positions held by the assistants, or staff, of the Manager.

"Depending upon the scope of the operations, the Manager, Military Railway Service will divide into grand divisions the standard military railway system to be operated. This Engineer Headquarters, Railway Grand Division, is commanded by a Colonel with the railroad title of general superintendent, and that headquarters is likewise divided into an Administrative section, a Transportation section, a Water Treatment section, an Engineering section, an Equipment section and a Stores section, and corresponds to a general manager's jurisdiction on an American commercial railroad.

"Depending upon the circumstances, a grand division is comprised of two or more railway divisions, each operated and maintained by a Railway Operating battalion, whose commander is a division superintendent with the rank of Lieutenant Colonel. These Engineer battalions, Railway Operating, are divided into a Battalion headquarters; a Headquarters and Service company; Company A, Maintenance of Way; Company B, Maintenance of Equipment; and Company C, Transportation. They correspond almost identically to the ordinary division superintendent's jurisdiction on an American commercial railroad.

"The Engineer battalions, Railway Shop, are organized along the lines of a standard back shop on any American steam railroad, and the battalion consists of an Erecting and Machine Shop company, a Boiler and Blacksmith Shop company, and a Car Repair company. The commander of this battalion is a Lieutenant Colonel, who shall be either an experienced superintendent of motive power and machinery, or a shop superintendent of a back shop on one of our big railroads. The location of these Shop battalions shall be determined by the Manager, Military Railway Service, and they shall be so situated as to take care of the heavy repairs of one or more grand division.

"It will be seen, then, that the policy of the War Department—which the American railroads have readily agreed to—is today to have the Military Railway Service of the army officered by practical railroad officers who will have appropriate ranks in the army and designated titles corresponding to the positions they occupy on an American railroad. . . . The officers of these Military Railway Service units are specialists in transportation and maintenance of equipment and way, and are capable of performing a real transportation service for the army. Assigned to each unit will be at least one regular army officer for liaison and a better understanding of the military side of the operations by the practical railroad men."

Iron and Steel Scrap Under Priority Control

DONALD M. NELSON, director of priorities, Office of Production Management, in an order effective October 11, has placed iron and steel scrap under full priority control.

This order, designed to relieve serious day-to-day shortages, authorizes the director of priorities to issue specific directions for deliveries of scrap. The order further provides that producers, dealers and brokers, and consumers of iron and steel scrap shall make monthly reports to the Priorities Division. Beginning November 15, producers will be required to report scrap inventories, production and sales; brokers will show inventories, purchase, and sales; and consumers must indicate inventories, production, receipts, and consumption of scrap metal. It is expected that, on the basis of these reports, a general policy for the distribution of scrap under mandatory orders, will be developed.

Scrap is defined in the order as "all ferrous materials, either alloyed or unalloyed, of which iron or steel is a principal component, which are the waste of industrial fabrication, or objects that have been discarded on account of obsolescence, failure or other reason."

The order emphasizes that the provisions of Priorities Regulation No. 1 apply to ferrous scrap. These provisions include prohibition of excess inventory, and stipulate that intra-company deliveries are subject to the same requirements that apply to inter-company deliveries.

Orders and Inquiries for New Equipment Placed Since the Closing of the October Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Locos.	Builder
Atlantic Coast Line	2	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
Bethlehem Steel Co.	1	0-6-0	Vulcan Iron Works
Chicago & Northwestern	1	380-hp. Diesel-elec.	Whitcomb Loco. Co.
Chicago Short Line	1	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
U. S. Army	1	80-ton Diesel-elec.	General Electric Co.
	1	45-ton Diesel-elec.	
U. S. Army, Engineering Dept.	1	45-ton Diesel-elec.	Vulcan Iron Wks.
U. S. Navy Dept.	1	30-ton Diesel-elec.	Fate-Root-Heath Co.
	1[1]	Fireless-steam	H. K. Porter Co.

LOCOMOTIVE INQUIRIES

Road	No. of Locos.	Type of Locos.	Builder
Bessemer & Lake Erie	2	2-10-4	.....
	2	0-8-0	.....
Duluth, Missabe & Iron Range	5	2-8-8-2	.....
U. S. Navy Dept.	11	Diesel-elec.	.....
U. S. War Dept.	5-25[2]	2-8-8-2	.....

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Cars	Builder
Birmingham Southern	100	50-ton box	Pull.-Std. Car Mfg. Co.
	100	70-ton gondola	
	10	50-ton cement	
Boston & Maine	10	Cabooses	Pull.-Std. Car Mfg. Co.
Chicago Great Western	200	50-ton merchandise	Pull.-Std. Car Mfg. Co.
Pittsburgh & West Virginia	100	50-ton box	Company shops
U. S. Navy Dept.	3	50-ton flat	Haffner-Thrall Car Co.
	1	50-ton box	

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Cars	Builder
American Steel & Wire Co.	65[3]	70-ton gondola	.....
	8	50-ton air-dump	.....
Bessemer & Lake Erie	425[3]	90-ton hopper	.....
	500	50-ton gondola	.....
Carnegie-Illinois Steel Corp.	10[3]	50-ton air-dump	.....
	10	70-ton air-dump	.....
Central R. R. of N. J.	50	70-ton cement	.....
Elgin, Joliet & Eastern	1,000[3]	50-ton gondola	.....
	200	50-ton flat	.....
Michigan Limestone & Chemical Corp.	19[3]	Air-dump	.....
National Tube Co.	3[3]	50-ton gondola	.....
	75	70-ton gondola	.....
	4	50-ton hopper	.....
	10	70-ton hopper	.....
Tennessee Coal, Iron & R. R.	10[3]	70-ton hopper	.....

PASSENGER-CAR ORDERS

Road	No. of Cars		
Boston & Maine	21	All-steel baggage	.....

[1] Cost, $19,960.
[2] For the Yunnan-Burma Railway in China. The materials for these locomotives are to receive an A-1-i priority rating.
[3] Purchase planned by U. S. Steel Corp.

Meanwhile, the Office of Price Administration has issued an amendment to the scrap schedule setting up Cincinnati, Ohio, as a basing point for scrap of railroad origin. The addition of Cincinnati as a basing point for railroad scrap, it was explained, represents a further refinement of the schedule, and places railroads in that area on a parity with sellers of industrial scrap.

OPA To Fix Prices of Carbon and Low-Alloy Steel Castings

MAXIMUM prices for carbon and low-alloy steel castings, "including railway specialties," will be established at or below current levels, it was announced September 30 by Leon Henderson, administrator of the Office of Price Administration.

Plans for the schedule, the OPA announcement said, have been discussed with representatives of 60 large and small producers; a separate session was held with the makers of railway specialties. Further discussions will take place with a representative committee which OPA is selecting "in order that the schedule of maximum prices may conform as closely as possible to present trade practices and methods." Consultation also will be had with buyers of castings before the ceiling is formulated.

The announcement went on to say that the general level of carbon and low-alloy steel casting prices has risen about 15 per cent thus far in 1941. It added that "because of the importance to industry, and particularly to the defense program," OPA "feels that a price ceiling should be established at or below the levels now prevailing."

A.A.R. Lumber Specifications

AT a joint meeting of the Car Construction Committee of the Association of American Railroads and representatives of the lumber manufacturers, the following six suggestions were advanced, not with the thought of making them mandatory or permanent practice, but simply for the duration of the present emergency and to help solve the problem of securing lumber required for new equipment and repairs:

(1) It is suggested that the demand for edge grain material be confined to sections requiring wearing material, and not be insisted upon for lining and interior roofing.

(2) Require edge grain or heartwood only for the kind of wood and for the part of a car where either is absolutely necessary.

(3) Some railroads order select grades for use in repairs instead of common grades as recommended in A. A. R. Specification M-907-33. Under present conditions that procedure is undesirable. The supply situation in the lumber industry possibly would be better served if the common grades were substituted for the select grades in the flooring, lining and inside roofing of repaired cars.

(4) As an emergency proposition only, on new and existing cars where it is possible, lining of double sheathed cars to be ordered in two pieces in varying lengths of six feet and up, and applied to suit nailing post spacing. This does not apply to single sheathed cars. In view of the present emergency this arrangement is brought to the attention of the individual railroads for such action as they see fit.

(5) The "Use Classification" on pages 4 and 5 of Specification No. M-907-33 provides for several kinds of wood suitable for each detail part. Because so many railroads have limited their acceptable woods it is suggested that, in view of the present emergency, mechanical officers give consideration to other suitable woods shown in the specification.

(6) Wherever it is practicable inspection to be made by authorized lumber inspectors at point of origin rather than at destination, also for railroads not equipped to make such inspection, that arrangements be made for such inspection by authorized inspectors of other railroads located in the vicinity of the district from which lumber is being shipped. The lumber manufacturers believe this will avoid rejections at destination. This arrangement might be agreeable to some railroads under the present emergency and is a matter for decision of individual railroads.

War Department Purchases Rail Equipment

PURCHASES of railroad equipment for the War Department by The Quartermaster General during the fiscal year ended July 1 amounted to $2,994,991, according to a statement recently released. This figure compares with purchases during the entire 10-year pre-emergency period from 1930 through 1939 of only $179,988.

The 1940-41 report, itemizing rail equipment purchased during the year, shows an expenditure of $1,026,395 for 65 gasoline-driven 20-ton locomotives. Other locomotives purchased were two 100-ton, three 60-ton, 10 45-ton, two 30-ton and two 20-ton units. In addition, the year's acquisitions include 260 tank cars, two railroad hospital unit cars and 19 25-ton locomotive cranes.

The major portion of the railroad equipment purchased by The Quartermaster Corps is used in government-owned yards of facilities serving military camps, posts, stations and depots for moving cars where this can be done either more speedily or at less cost than with equipment owned by common carriers, or where the use of railroad-owned equipment would interfere with the handling of civilian traffic, it was pointed out. The locomotive cranes are used to unload heavy items such as combat tanks, automobiles, structural steel, etc.

Equipment Purchasing and Modernization Program

Chicago, Milwaukee, St. Paul & Pacific.—The C. M., St. P. & P. has asked the Interstate Commerce Commission for authority to assume liability for $2,744,000 of equipment trust certificates, maturing in 14 equal semi-annual instalments of $196,000 on May 1 and November 1, beginning May 1, 1942, and ending November 1, 1948. The proceeds will be used as 50 per cent of the purchase price to finance the construction in the company's own shops of new equipment costing a total of $5,488,750 and consisting of 1,000 40 ft. 6 in., all-steel box cars; 500 40 ft. 6 in., all-steel automobile cars; 500 50-ton self-clearing hopper coal cars; and 25 steel cabooses.

Erie.—The Erie is building new car repair yard facilities at Marion, Ohio, and a new coaling station for the eastbound main track at Kent, Ohio. The work is being done by company forces.

Florida East Coast.—Receivers for the Florida East Coast have applied to the Interstate Commerce Commission for approval of a plan whereby they would issue $1,000,000 of 2¾ per cent equipment trust certificates, series J, to be sold to the Reconstruction Finance Corporation at par for the purpose of financing approximately 90 per cent of the cost of three Diesel-electric locomotives, 60 freight cars, and six stainless-steel passenger-train cars. The certificates would mature in 20 semi-annual installments on each May 1 and November 1 from 1942 to 1951.

Missouri Pacific.—The Missouri Pacific has asked the Interstate Commerce Commission for authority to assume liability for $4,185,000 of equipment trust certificates, maturing in 15 equal annual installments of $279,000 on November 1 in each of the years from 1942 to 1956, inclusive. The proceeds will be used as 75 per cent of the purchase price of new equipment costing a total of $5,596,461 and consisting of 100 50-ton, 50 ft. 6 in. auto-parts cars; 50 70-ton covered cement cars; 800 50-ton, 40-ft. 6 in., all-steel sheathed box cars; 200 50-ton, 50 ft. 6 in. automobile cars; and 500 70-ton, 40 ft. 8 in. hopper cars.

Reading.—The board of directors of the Reading have authorized the construction of 1,000 steel hopper coal cars of 55-tons' capacity at an estimated cost of $2,500,000. E. W. Scheer, president of the railroad, announced that the cars would be built in the company's own shops at Reading, Pa., "if and when material becomes available."

Seaboard Air Line.—Receivers for the S. A. L. have applied to the Interstate Commerce Commission for approval of a plan whereby they would issue $3,552,000 of 2½ per cent equipment trust certificates, series KK, to be purchased at par by the Reconstruction Finance Corporation or sold with the guarantee of that agency. The certificates would mature in 24 semi-annual installments of $148,000 each on April 1 and October 1 of each year from April 1, 1942, to October 1, 1953. The equipment, to be purchased at a total cost of $4,838,479. Orders for this equipment were published in the August *Railway Mechanical Engineer.*

Union Pacific.—The U. P. has applied to the Interstate Commerce Commission for authority to issue $13,250,000 of 1¼ per cent equipment trust certificates, series G, to finance in part the acquisition of equipment which will cost approximately $16,562,500. The equipment includes 2,000 steel box cars to be built in company shops, and the following to be acquired from builders: 20 4-6-6-4 locomotives, 30 mixed chair cars, 30 baggage cars, 10 mail-baggage cars, 100 cabooses.

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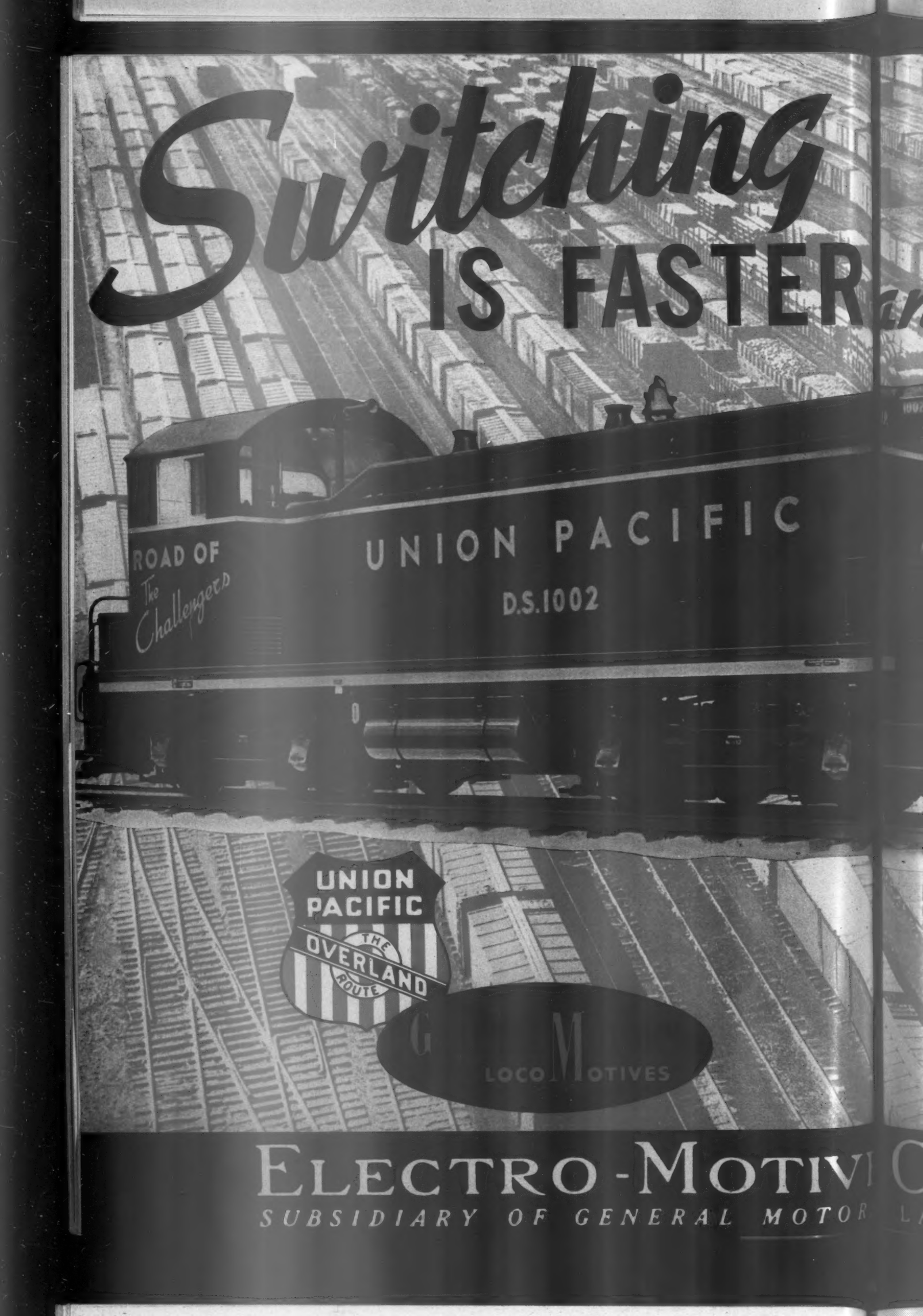
Switching
IS FASTER
ROAD OF
The Challengers
UNION PACIFIC
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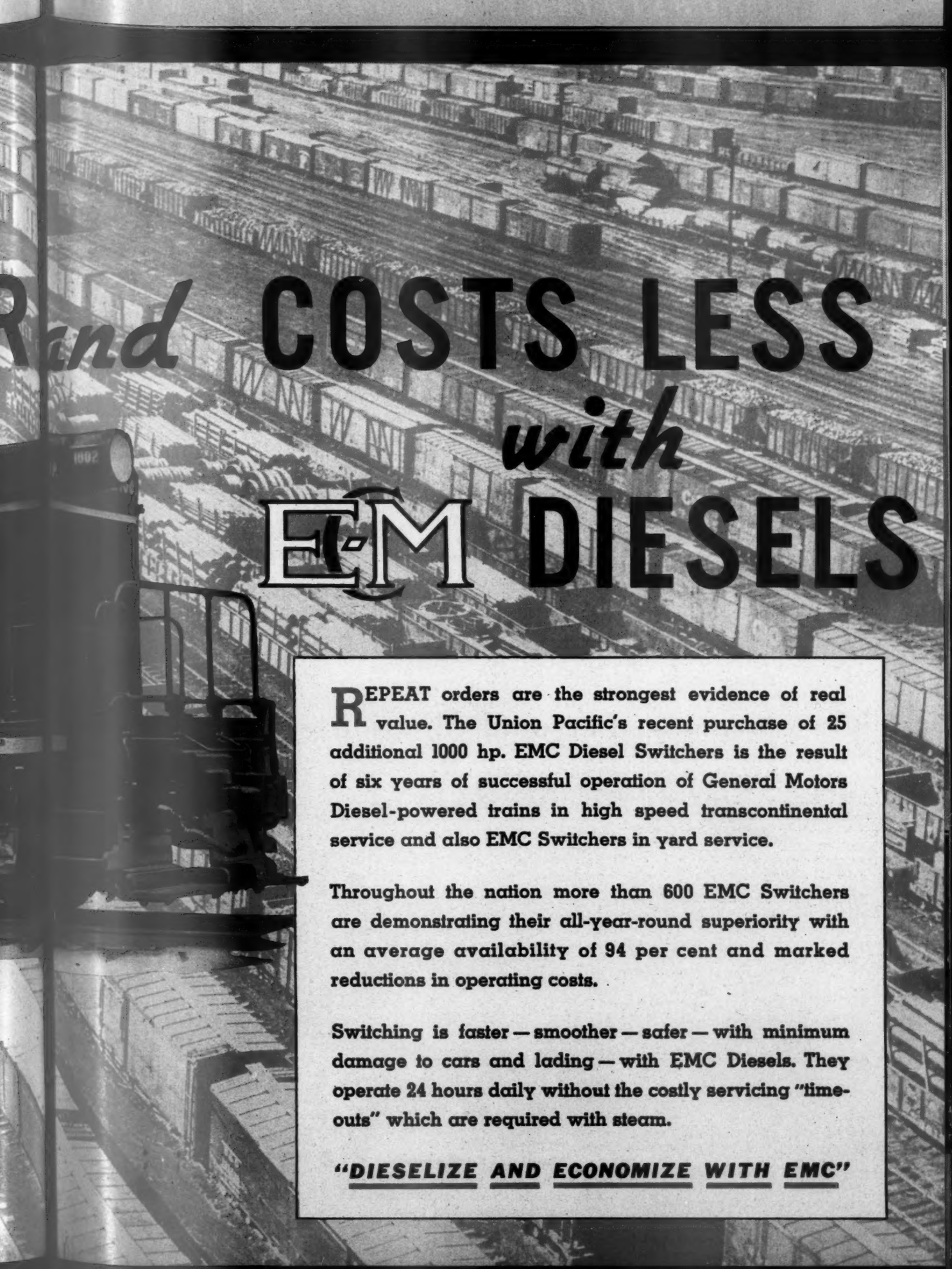

Rand COSTS LESS *with* E-M DIESELS

REPEAT orders are the strongest evidence of real value. The Union Pacific's recent purchase of 25 additional 1000 hp. EMC Diesel Switchers is the result of six years of successful operation of General Motors Diesel-powered trains in high speed transcontinental service and also EMC Switchers in yard service.

Throughout the nation more than 600 EMC Switchers are demonstrating their all-year-round superiority with an average availability of 94 per cent and marked reductions in operating costs.

Switching is faster — smoother — safer — with minimum damage to cars and lading — with EMC Diesels. They operate 24 hours daily without the costly servicing "time-outs" which are required with steam.

"DIESELIZE AND ECONOMIZE WITH EMC"

VI CORPORATION

OR LA GRANGE, ILLINOIS, U. S. A.

Supply Trade Notes

C. C. CLARK, sales manager of the Central district of the Pressed Steel Car Company, Inc., with headquarters at Pittsburgh, Pa., has been appointed sales manager of the Western district, with headquarters at Chicago.

◆

MANNING, MAXWELL & MOORE, INC.—*Harry G. Johnson* has been appointed salesman for the Indianapolis, Ind., territory of Manning, Maxwell & Moore, Inc., to succeed *Gerald Beebe*, who has been granted an extended leave of absence due to illness.

◆

COOPER-BESSEMER CORP.—*B. B. Williams*, chairman of the board of the Cooper-Bessemer Corporation has again taken over the duties of the president, succeeding *Charles B. Jahnke*, deceased. *Gordon LeFebvre*, vice-president and general manager and *L. F. Williams* have been elected directors of this corporation.

◆

THE COLUMBIA STEEL COMPANY, subsidiary of the United States Steel Corporation, is planning a program to increase the capacity of its Pittsburg, California plant. The program includes the addition of a new semi-continuous rod mill, together with billet heating furnaces, rod cooling and handling equipment. The rod mill will be housed in a new building to be built east of the plant's open-hearth building. The plant's wire and nail mill will be improved and extended to include additional wire drawing and nail machines, and new facilities for the manufacture of some wire products, the production of which was formerly confined to eastern mills. The warehousing facilities of the wire mill will also be increased and some changes made to the primary rolling mills, allowing production of longer rod billets. The steel-making capacity of the Pittsburg plant is being increased to the extent of 77,000 net tons of ingots annually by the installation of a new open hearth furnace and by an increase in the capacity of the four existing open hearth furnaces. The program will require extension of the plant's open hearth buildings, the addition of new ladles, an additional ladle crane and a new charging machine.

◆

GALE SERVICE & CONSTRUCTION CO.—*W. C. Thatcher*, vice-president of the Gale Service & Construction Co., Chicago, has been elected president, succeeding *Frederick A. Gale* who died on July 10. *O. C. Rome* has been elected vice-president to succeed Mr. Thatcher. Before their connection several years ago with the Gale Service & Construction Co., both Mr. Thatcher and Mr. Rome were associated for 22 years with the National Boiler Washing Company of Illinois.

◆

THE AMERICAN LOCOMOTIVE COMPANY has established a department of information under the direction of *Lynn C. Mahan*, to have charge of all public relations activities and the handling of inquiries from the press and public, seeking information on the company's operations. The new department will have its headquarters at the company's New York office, 30 Church street.

Obituary

FREDERICK W. WERNER, assistant to the president of the United States Steel Corporation in charge of coke by-products sales, died September 29 in the Flushing hospital, Long Island, N. Y., after an illness of several months. He was 52 years of age.

Personal Mention

General

J. W. ECKSTEIN, master mechanic of the Akron, Canton & Youngstown and the Northern Ohio, has been appointed superintendent of motive power, with headquarters as before at Akron, Ohio. This is a change of title.

EDWARD J. BALL, superintendent of shops on the New York, New Haven & Hartford at Van Nest, N. Y., has been appointed superintendent of electric and Diesel locomotive maintenance, a new position, with headquarters at New Haven, Conn.

Master Mechanics and Road Foremen

G. L. FISHER has been appointed master mechanic on the Erie at Buffalo, N. Y.

E. LUNDSTROM has been appointed a road foreman of engines on the Denver & Rio Grande Western with headquarters at Salt Lake City, Utah.

B. E. JONES, master mechanic on the Erie at Buffalo, N. Y., has been transferred to Secaucus, N. J., succeeding C. H. Norton, retired.

JAMES E. FITZGERALD, general foreman of the South Boston, Mass., passenger yards, on the New York, New Haven & Hartford, has been appointed assistant master mechanic of the Boston division.

E. BRANNING has been appointed master mechanic on the Erie at Hornell, N. Y., succeeding E. Pool, who has been granted a leave of absence.

JAMES E. HALL, traveling engineer on the Union Pacific, has been appointed road foreman of engines, at East Pittsburgh, Pa., succeeding John W. Wyke, retired.

HARRY W. MAXWELL, assistant master mechanic of the Boston (Mass.) division, on the New York, New Haven & Hartford, has been appointed master mechanic, with the same headquarters.

Car Department

F. F. LENTZ, assistant master mechanic and general car foreman of the Akron, Canton & Youngstown and the Northern Ohio at Akron, Ohio, has been appointed superintendent of the car department, with headquarters at Akron. This is a change of title.

Shop and Enginehouse

R. H. MICHALEK has been appointed assistant general foreman on the Boston & Albany at West Springfield, Mass.

WALTER R. SEDERQUEST, master mechanic of the Boston (Mass.) division, on the New York, New Haven & Hartford, has been appointed superintendent of the Readville (Mass.) shops.

K. D. READ has been appointed shop superintendent on the Boston & Albany with headquarters at West Springfield, Mass.

L. A. HARTLEY, enginehouse foreman on the Erie at Hornell, N. Y., has been appointed supervisor of apprentices, with headquarters at Cleveland, Ohio.

F. D. DUNTON, supervisor of apprentices on the Erie with headquarters at Cleveland, Ohio, has been appointed general foreman at Avoca, Pa.

JOHN W. O'MEARA, superintendent of the Readville (Mass.) shops on the New York, New Haven & Hartford, has been transferred to the Van Nest (N. Y.) shops.

FRANK C. GOBLE, road foreman of engines, on the New York, New Haven & Hartford, has been appointed general air brake inspector, with headquarters at New Haven, Conn.

JOHN HARTHILL, general boiler foreman of the New York Central at Collinwood, Ohio, has retired. Mr. Harthill is a charter member of the Master Boiler Makers' Association.

T. J. LYON, shop superintendent on the Boston & Albany at West Springfield, Mass., has been appointed general foreman of the locomotive shop on the New York Central with headquarters at West Albany, N. Y.